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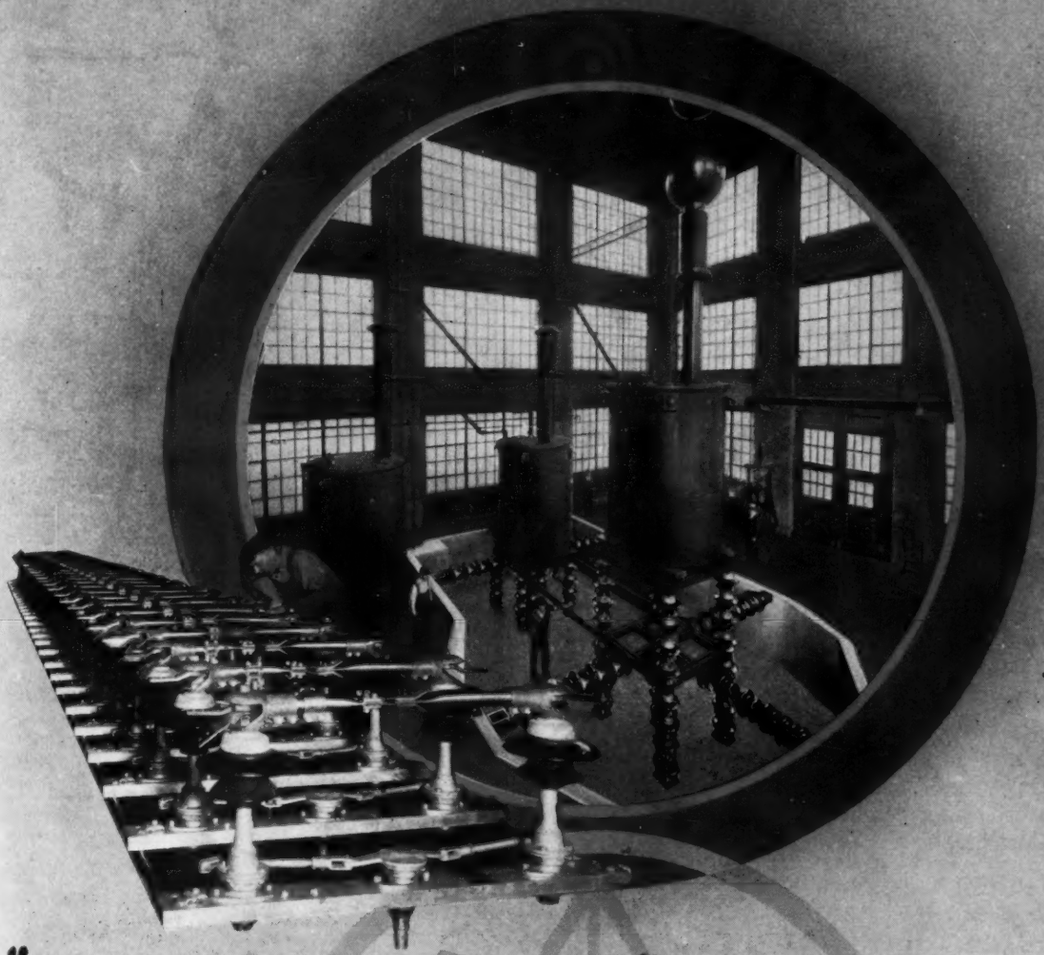

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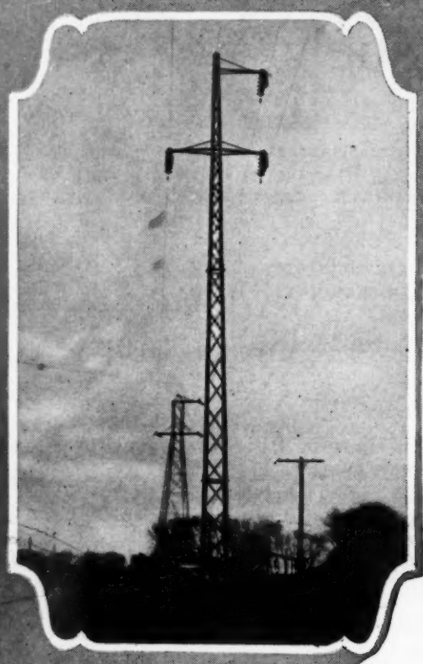
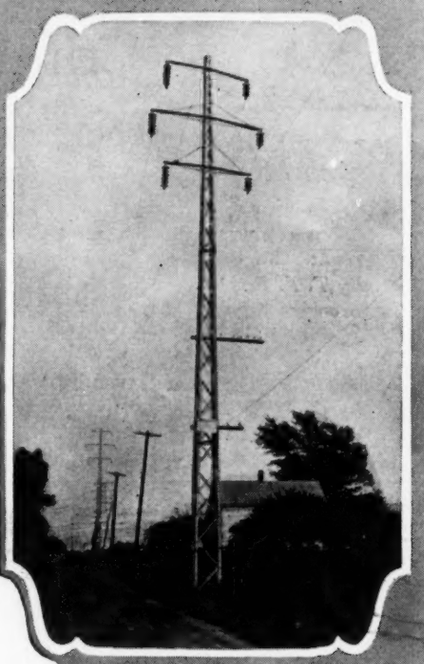
TRANSMISSION POLES

for use where right-of-way conditions limit the size





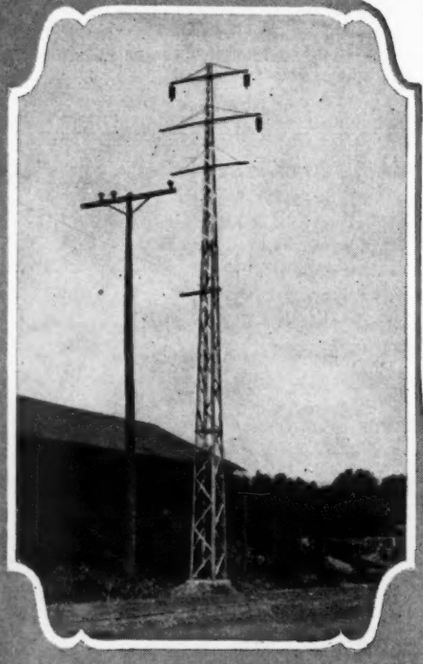
THE use of narrow base poles for high tension transmission lines is necessarily expensive but their use is required where the right of way is limited.

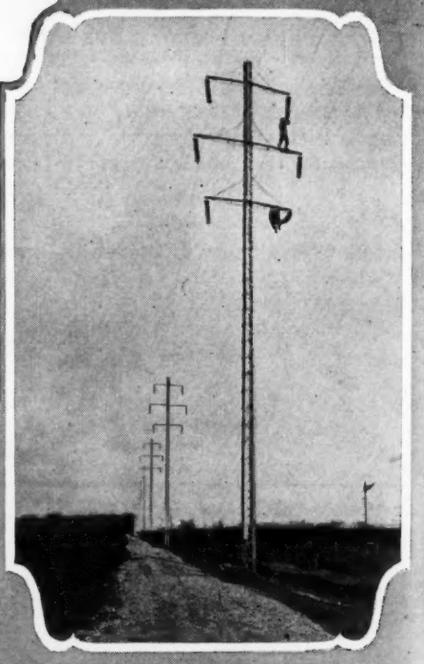
Where they are used as a part of or comprise a main trunk line, it is of great importance that the design and details be correct in every respect.

The illustrations show a few of the lines on which narrow base poles have been used.

We have designs of standard poles of various heights, and voltages up to 66,000. The higher voltages usually require special designs. The lower right hand photograph illustrates a 120,000 volt line.

All of these poles, by reason of their design, offer resistance to torsional loads.





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Mergers and the Rights of Security Holders

A CONSEQUENCE of the current movement in the utility field toward company mergers is increased vigilance on the part of big investors lest the rights or privileges of certain classes of security holders may have been altered in the merger process. Naturally the rights of the voting stockholders have been considered. Those initiating large mergers have been known to be less solicitous of the rights of other investors. Sometimes subtle changes may take place in the position of preferred stockholders or bondholders without any legal manifestation. A case in point occurred in connection with a recent utility merger. A large utility, A, absorbed an almost equally large company, B. Superficially, the position of the preferred shareholder of the latter company had not been altered in the least. Actually, it had been seriously jeopardized. Holders of this preferred stock had the guarantee of a pro rata dividend increase should any dividend increase beyond a stipulated percentage prove feasible in the case of the common stock. Although the new dividend on the common stock of the merged companies exceeds the stipulated percentage, the preferred shareholders of company B are still receiving the original return. Naturally the utility in question has lost the confidence of this class of investor—one of the largest, incidentally, in America.

A similar situation sometimes arises in connection with a bond issue. Mortgage indentures usually provide for alteration of the terms of the mortgage on an 80 or 90 per cent vote. While having obvious advantages, such a provision may work to the detriment of those whom it is designed to benefit, especially after a complex merger has been consummated.

Fiduciary institutions and other large investors have greatly widened the market for utility securities. But they are also setting up more rigid requirements than does the individual investor as a rule. Lack of scrupulous attention on the part of the utilities concerned to the interests of every investing faction undoes years of effort to have these securities legalized for trust or savings-bank investment.

* * * *

Accidents Should Be Treated as Preventable Expense

ACCIDENT prevention is neither a fad nor a hobby. Besides its humanitarian aspects, it is strictly an economic proposition, because, all in all, accidents are an expensive business whether they happen to employees or to the public. However, men and engineers in charge of accident prevention complain of the attitude of workmen toward safety rules and regulations. Workmen, it is asserted, are inclined to look upon the safety man as just a "darned nuisance," and hence they are inclined toward half-hearted observance of the rules. Two very real reasons for such an attitude may be found. The safety man may have to do his work without the necessary authority to enforce safety regulations, or he may be trying to accomplish results largely by inductive treatment—that is, spreading safety propaganda in the hope of stimulating latent interest always to be careful. In either case responsibility and discipline are lacking. It should be remembered that a great many of the men in the electrical industry who are most liable to accidents take a certain amount of pride in being "hard-boiled," and it takes "hard-boiled" methods to make them take care of themselves.

Safety work never has succeeded and never will succeed without the aid of the executive in charge. He must impress upon his force that safety is part of the operation of the property and that each member of the organization in a supervisory capacity will be held responsible for the safety of the men under him with the same rigidness exercised over any other part of the work. Accidents should be treated just the same as any other preventable expense in business. Safety meetings and promotional material encouraging the safety idea have their place and should be continued, but they will lose 90 per cent of their effect if not backed up with regulations that can be and are enforced. Responsibility for accident prevention cannot be divided, but is shared equally by every department head and employee from executives down to the last ground man. If disciplinary measures are necessary, they should be taken in the interest of the common cause.

* * * *

Flood Control by Power Companies

THE value of storage reservoirs in connection with water-power developments was admirably demonstrated during the recent floods in New England. Seven stations of the New England Power Company on the Deerfield River continued in service throughout the flood owing to the regulation of flow of the Deerfield River by the use of storage reservoirs at Davis Bridge and Somerset. Notwithstanding that the drainage area of the river was in the heaviest portion of the deluge, the reservoirs could have withstood a flood twice the magnitude without one drop of water passing over the spillways. Thus property in the Deerfield Valley was safeguarded and the economic justification of the engineering works of the power company was demonstrated in a remarkably dramatic manner.

New York could well profit from the experience of New England. Surveys indicate that approximately one million horsepower could be developed on the interior streams of the Empire State through the use of similar

storage reservoirs. These New York streams are of seasonal flow, with floods in spring and low water in summer. Scientifically developed and with their floodwaters impounded, damage from flood on these rivers would be minimized and power production increased. Yet no reservoirs are permitted in the Adirondack Mountains.

However, the Black River has been regulated, and when the great Sacandaga Reservoir is finished on the Upper Hudson the floods which do so much damage in Albany and neighboring communities will be effectually checked and at the same time the power value of the Hudson will be materially enhanced. While these river-regulating districts in New York are state agencies, the increased value of power rights below the reservoirs carries the bulk of the payments and neither the public treasury nor the taxpayer at large is called on for a dollar of the cost. Opportunity for reservoirs also exists on the Genesee, Delaware and other streams. The slowness with which the opportunity is seized is due largely to prejudice and misunderstanding on the part of those who think of reservoirs as unsightly, stagnant and unhealthful pools, though they can be made beautiful lakes, and of hydro-electric stations as ugly edifices, though they are capable of attractive architectural design. If the wrong conceptions held by well-meaning citizens could be obliterated from their minds, water supply could be augmented, floods prevented and the supply of electricity materially increased.

* * * *

Pioneers and Skeptics

TO PIONEER the sale and use of new devices and material from little-known sources of manufacture is a strenuous task when the movement of such products into the market confronts the skepticism of a purchaser whose views are inflexible and more than normally conservative. Even long-established concerns often find it difficult to persuade customers to try out new equipment until other more enterprising buyers have made the plunge, and sometimes it is nothing short of ludicrous to see how purchasers in a given region wait for others to commit themselves before falling into line with orders for guaranteed apparatus and supplies of new design. There is a great deal of human nature in the purchasing "game," and this makes it interesting as well as baffling on occasion to the producer of new material which might seem to be capable of selling itself on its own merits, but somehow is not.

Progress depends upon many things in this industry, and one of our chief causes for thanksgiving is the open-mindedness of enough buyers to permit worth-while products to make their way into general acceptance. It is not unjust that new organizations must win their reputations as they build markets for their products, but prejudice and snap judgments should be taboo among buyers. In this connection far too much weight is sometimes given by purchasers to initial failures of equipment or material, and condemnations of new devices or products occasionally pass from month to month with singularly little thought about their accuracy. In the intimate informality of committee work it is all too easy to circulate sweeping opinions about products which would never be allowed to be spread abroad in the more careful interchanges of regular company business, and sometimes this freedom works real hardship upon both old and new manufacturers.

There is room for some to adopt a more judicial attitude in relation to purchasing. It is important to be sure that new products shall have service tests under conditions for which they were designed and sold before reaching conclusions as to their adaptability for particular needs. Engineering analysis should be called into play oftener when considering the usefulness and performance of new products. Manufacturers should not expect that even superior products will sell themselves in these days of close competition for the attention and interest of the purchaser. It takes a long time to determine the limitations of many products in field service, and while we heartily commend the practice of interchanging experiences and opinions on these matters, we would emphasize once more the dangers of reaching conclusions based on inadequate information. The electrical industry needs both pioneers and questioners for its proper development, but, most of all, progress demands minds wide open to the truth, no matter where it leads.

* * * *

When Industrial Managers Are Most Receptive

WHEN are the opportune occasions for demonstrating the full value of purchased power? Probably the outstanding time is when private generating equipment is becoming obsolete so far as economy is concerned or when it is approaching the termination of its useful life. Then it is that the manager will most readily recognize that if he purchased power he wouldn't have to think of obsolescence charges on plant equipment, decreasing economy of generation, need of raising money to revamp or rebuild his plant, and the inconvenience of reconstruction. Then it is that the value of the power-plant space for other manufacturing purposes or leasing seems more real. It is the time when he can possibly comprehend the greater return from capital diverted to producing manufacturing and distribution economies. The nuisance of coal and ash handling becomes less mythical. Even the small ratio which power cost bears to manufacturing cost may have more significance. When plant replacement is necessary, the industrial management can save itself the future burden of carrying fixed charges on a generating plant over an industrial depression. Past coal strikes and the difficulties of obtaining fuel can be recalled. Even the time consumed in executive supervision of plant expenditures and operation and the inconvenience of private-plant outages may be more freely admitted under the circumstances assumed.

Again, opportunity arises when power supply must be augmented to care for increased manufacturing facilities. Many of the foregoing advantages of purchased power will also be recognized in this case. In addition it can be emphasized that there will be an avoidance of delay in receiving power and the resultant loss of manufacturing profits, since an unlimited supply of purchased power can be provided in a relatively short time. At this time, too, the advisory service of the sales engineering staff on making applications of power and effecting economies can be most readily capitalized. Breakdowns of private plants or serious interruptions to their power supply afford other opportunities for utility companies to demonstrate their capacity for prompt and unlimited service. Prolonged coal strikes afford still another occasion. At such times industrial managements will lend a more willing ear to evidence that seemed to have little persuasive force before.

When industrial managements are much concerned with their operating costs an excellent time is provided for utilities to offer to install meters on all the power-consuming devices of such firms and analyze their power requirements for them. Doing so will afford useful data to both the manufacturer and the utility and may be the means of an eventual change-over to purchased power.

Many industrial and commercial private plants are reaching the stage where the managements will listen more interestedly to the story of the advantages of purchased power. Meanwhile utility power sales engineers can spread the same gospel to building and factory managements which are just considering what their source of power shall be. They have made no investment yet and should for this reason be easier to convince.

* * * *

Lehr und Kunst

WORN for years on the pin of a prominent engineering school, and broadly translated by the phrase "Theory and Practice," the above motto signifies a present-day need in individual thinking. A cross-section of modern electrical engineering reveals an amazing range of activity extending from commercial expansion to the research laboratory. The balance between development work and the business of making money electrically has been sanely maintained from the early days of the art, but today's resources encourage such extreme specialization that there is danger of acquiring individual narrowness of outlook unless definite effort is made to cultivate wide interests. A recent saying attributed to Dr. Mayo that "a specialist is one who knows more and more about less and less" has its humorous side, like the definition of an expert as "an ordinary man away from home," but it carries a warning against intellectual provincialism which should be heeded.

In the absorption of work in sharply defined fields it is easy to overlook what might be called cultural technology. Younger engineers need to pursue general development to attain seasoned judgment, and older men need it to maintain open minds and a perennially fresh viewpoint. Within a generation theoretical electricity has undergone an upheaval of almost incredible magnitude. Parallel to this has been advancement in practice upon a scale of such accelerating speed that even those whose business it is to keep in sight of the front line must put forth their utmost efforts to remain in the race. Never was the need of balanced reading greater, or the importance of selectivity in interests.

The mortality of theories sometimes leads engineers to cast basic studies aside and to plunge into the absorbing interests of application to the neglect of principles and mental speculations. Likewise, research men are prone now and then to pass by on the other side when economic matters occupy the agenda. Granted that a wide gap must exist between sales activities and competence to elaborate a theory of magnetism comparable to that of the atomic model, intellectual footbridges are available in the shape of books and periodicals to span the chasm. Millikan, Darrow and others are building these passageways, and if they are insufficiently used, the electrical industry will suffer from local inbreeding. The scriptural saying that "the life is more than meat and the body more than raiment" applies to science and engineering, with their marvellous applications to human welfare in almost as true a sense as it does to matters of the spirit.

The Industry Sales Conference— What Should It Do Next Week?

ON MONDAY of next week the industry sales conference will convene in New York in the offices of the Society for Electrical Development. Here begins for electrical men a new adventure in co-operation, an excursion into the realm of markets on a larger scale than has ever been attempted or even considered by the organized industry before. The generally accepted purpose of the conference is to set up a comprehensive program to secure the adequate rewiring of the sixteen million homes now using electricity so incompletely. It is well to ponder not only the desirability and possibilities of such a movement, but also the several fundamental factors that will have to be related and adjusted to any program which will hold promise of attaining this end.

Wiring.—If the homes of America are to be rewired so that adequate facilities shall be provided for the use of all the practical appliances, one thing is sure. The electrical contractors must do the wiring. Yet today virtually all housewiring is installed by the small price-squeezing "curbstone" contractors. They do not belong to any association. A large percentage of them buy materials from the mail-order house and ten-cent stores. They receive almost no advertising and read no electrical publications. They are entirely out of touch with industry plans, purposes and policies. But they are doing the wiring in the American home. Some way must be found to educate, stimulate and guide this unorganized army of individualists to install more adequate facilities.

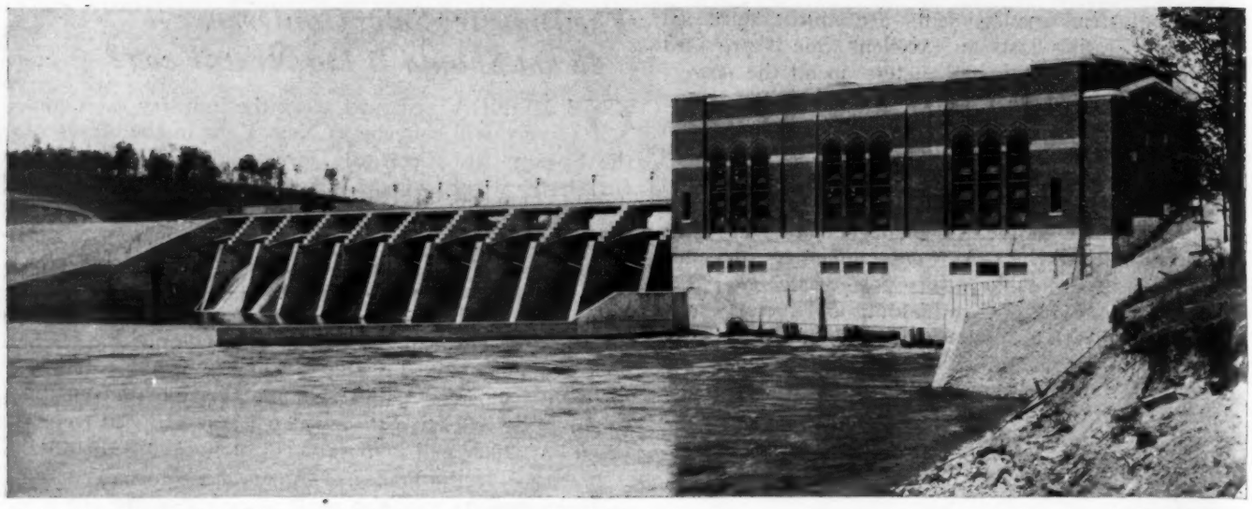
Inspection.—If a better job of house wiring is to be done throughout the country, the help of the industry's inspection forces is needed—through a more uniform interpretation of the code and a helpful influence toward adequacy—in the public interest. The inspectors are now combining their various associations and must be encouraged to co-operate.

Ordinances.—If uniformity in inspection is desirable, uniformity in ordinances is also needed. This work is under way and should be facilitated.

Merchandising.—If outlets are installed in these homes in adequate numbers, the merchandising of appliances must be accelerated if load is to materialize and the public benefits are to be realized. To this end there is vital need for some adjustments of central-station merchandising policies, that there may be more harmony among the dealers and a greatly increased flow of appliances through more healthy outlets into the homes. The N.E.L.A. and the national associations of the dealer groups are now endeavoring to work out a national standard of merchandising practice. It is vital to such a broad industry program.

Advertising.—The electrical industry has never learned to spend money in the marketplace, but it is now in very active competition with other industries that do. And if the homes of America are to be rewired and completely applianced, electrical men will have to meet the pace of modern business and advertise both nationally and locally, both to the public and to the trade, on a scale commensurate with the size and richness of the waiting harvest.

The industry sales conference when it sits down to work next week will face these basic problems. It will take courage to tackle them. It will require no little work and thinking. But the end is worth the effort and the industry will be watching very hopefully.



A Temple to the New Gods

GOTHIC doors and window arches, warm reds and browns in the texture of tapestry brick, leaded-glass windows of varicolored stain, pointed lanterns across the dam and wrought-iron bracket lanterns on the building walls, inside and outside, blend the strictly utilitarian lines and forms of at least one electric generating plant into a strikingly beautiful whole. This plant is the first of two owned by the Northern Electric Company of Wisconsin to be completed on the Menominee River—a boundary stream between Wisconsin and Michigan. It is the Chalk Hill station. Note the variegated colored-tile floor, stained-glass windows and ornamental brackets in the generator room. Arched windows, tapestry brick and lanterns on dam add to the exterior attractiveness.

Experience with Oil Reservoirs for Preventing

Voids in High-Tension Cable

Brooklyn Edison Company finds them very satisfactory with 27-kv. cable system. Old cables rejuvenated. Details of installations

By T. F. PETERSON
Brooklyn Edison Company

WHEN the 27-kv. system of the Brooklyn Edison Company was begun in 1922, the paramount idea influencing the design and manufacture of cable, as well as its subsequent installation, was that voids and moisture were largely responsible for cable and joint failures. Accordingly, provisions were made to maintain pressure within the cable above atmospheric at all times by means of suitable reservoirs at the high points of feeder lengths; in this way insuring against the existence of voids or the entrance of moisture and air. Before making any installations an extensive program of research was carried out covering the migration of compound in cable and the design of proper reservoirs and stop joints.

In order to determine the extent of compound movement that could be expected in installed cable, a 240-ft. length of three-conductor 250,000-circ.-mil $\frac{17\text{x}11}{64}$ paper-insulated cable was coiled in a vertical helix on a 7-ft. diameter drum, 8 ft. high. Compound levels and pressures at conservators on cable ends were carefully observed during temperature cycles. Results of these tests indicated that, following the initial filling of voids (formed during bending) that took place at the first heating, there was very little movement. Furthermore, no sheath expansion could be detected during these temperature cycles (24-hour period and 55 deg. C. maximum sheath temperatures). The general conclusion drawn at that time was that, under the ordinary conditions of a sealed cable system, migration was not a matter of much concern. On the other hand, it was quite evident that a break in a lead sheath at a low level could result in the slow bleeding of cable. In view of these conclusions it was deemed unnecessary to proceed further with the design of a stop joint. However, steps were taken to obtain data on migration in installed cables. An attempt was made to determine the magnitude of forces prompting the movement. In some cases pressures of +3½ lb. per square inch at low levels and —3 lb. per square inch at high points were found to exist.

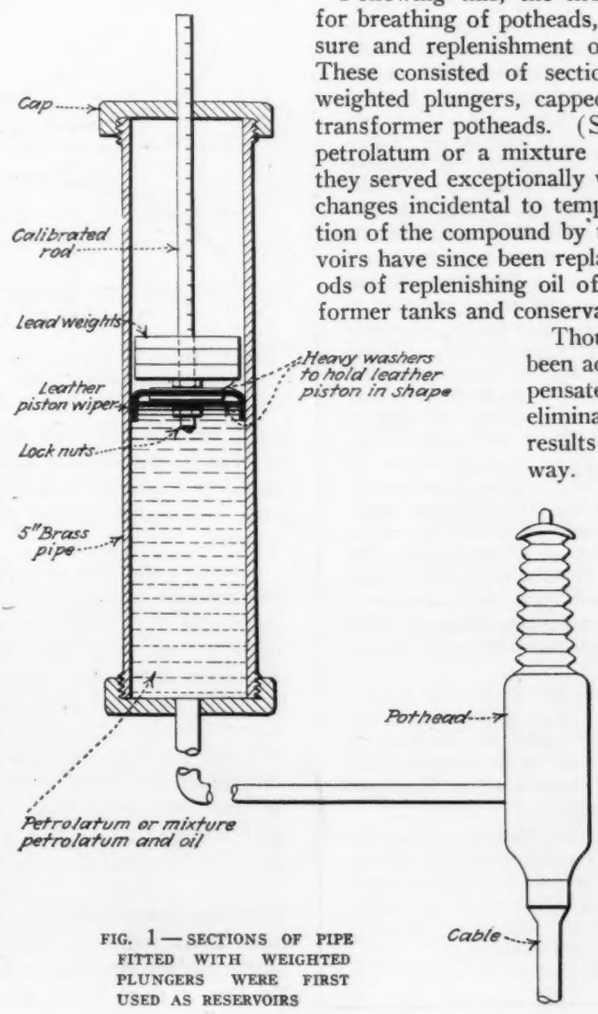


FIG. 1 — SECTIONS OF PIPE FITTED WITH WEIGHTED PLUNGERS WERE FIRST USED AS RESERVOIRS

Following this, the first practical means to provide for breathing of potheads, maintenance of internal pressure and replenishment of oil to cable were installed. These consisted of sections of 5-in. pipe fitted with weighted plungers, capped at both ends and piped to transformer potheads. (See Fig. 1.) When filled with petrolatum or a mixture of petrolatum and transil oil, they served exceptionally well to compensate for volume changes incidental to temperature variation and absorption of the compound by the cable. These crude reservoirs have since been replaced by our present-day methods of replenishing oil of potheads by piping to transformer tanks and conservators.

Though these could probably have been adapted to 27-kv. joints to compensate for volumetric changes and eliminate vacua, it was felt that better results would be obtained in another way. Early in 1924 twenty collapsible, bellows-type reservoirs filled with petrolatum were installed at the high joints of feeders. These were inspected at regular intervals. Changes in height were such as to indicate very slow migration. Subsequently other weighted bellows, some filled with petrolatum and others with oil, were added. These remained for approximately two years. At the end of this time considerable evidence substantiating migration theories was obtained. Many of the reservoirs were entirely devoid of oil; others contained large voids. The results were in entire agree-

Oil Reservoirs Used at Every Manhole on High-Tension Cable System

DURING the past five years an energetic program of cable and insulation research has been in progress in the Brooklyn Edison Company. The results, though by no means final or complete, have been very gratifying and have been reflected in the marked improvements made in cable performance. This improved performance is due both to better manufacture of cable and to progress and refinement in handling, jointing, testing and maintaining cable made by the operating company. One of the most important features in this progress has been the introduction of oil reservoirs on potheads and joints of cable which are operating at 27,000 volts.

In the early stages of the redesign of the transmission system of the Brooklyn Edison Company in 1922 it was determined to make 27,000 volts the basic transmission pressure for future developments. Before placing this system in operation a great deal of thought and study were given to the various factors of cable design and method of testing and jointing cables. In this analysis three fundamental factors essential to the good performance of the cable system were brought out: Thorough oil impregnation, elimination of moisture and elimination of air voids. It was found that cable could be manufactured that had these three characteristics in good shape at the time of testing in the factory, but subsequent handling, permitting oil leakage from the cable, air and moisture entrance and the continuous absorption of oil into the paper fibers, would result in inferior cable when installed in the duct system. After a cable is operated with its heating and cooling there is migration of oil in the cable, and although of very slow movement, it may be very effective in causing deterioration. Vacua of considerable magnitude have been found within cable when the lead caps are moved for installing. This condition allows the plugging in of considerable air with its entrapped moisture.

As a result of this analysis the Brooklyn Edison Company adopted the policy, at the initial installation of the 27,000-volt system in 1922, of installing oil reservoirs on the cable system wherever possible. These reservoirs were first installed at the transformer and substation switch connections with the hope of insuring a positive pressure above atmosphere throughout the cable system at all times. It is self-evident that, with the pressure maintained above atmosphere and oil for filling in voids, any leak that might occur would cause a leakage from cable to the outside which could be detected before moisture could leak into the cable. It was found that the migration of oil throughout the cable was so slow that these reservoirs on the transformer potheads were not sufficient to maintain a positive pressure throughout any great length of cable, and the next step was to introduce reservoirs at the joints within the manholes.

This practice has been expanded until it is a very general custom to use reservoirs on 27,000-volt cable joints in every manhole on the cables the company is installing at the present time, and to go back over all of the older cables and install reservoirs in locations where inferior cable is installed.

The accompanying paper by Mr. Peterson gives the development of this principle on the Brooklyn Edison system, and it is of interest to note that it has been possible to rejuvenate old cable, which would not stand up under 27,000-volt operation, to such an extent as to make it a very reliable 27,000-volt cable.

ment with observations of a different character—for example, (1) collapse of joints was being reported by some companies; (2) the local system experienced a great number of joint failures apparently due to lack of compound despite the fact that filling was once complete; (3) joints could be refilled—that is, would allow addition of compound at six-month intervals. (Incidentally, this practice greatly reduced the number of failures obtained.) Only one conclusion could be reached, and that was that compound did migrate.

Voids and Air Pockets in Cable and Joints

The early statements and ideas on internal cable pressure were what one might call "over-all" or "boundary" contentions. They dealt not so much with the detailed mechanism of the creation of voids, air pockets, etc., but

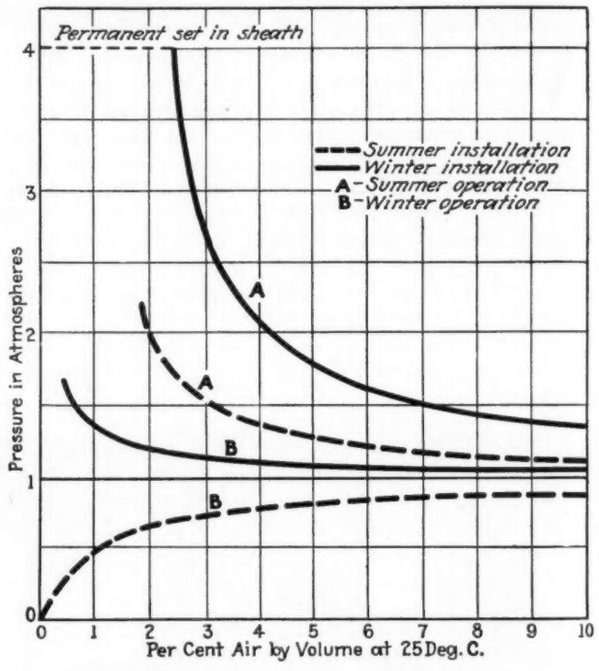


FIG. 2—PRESSURE VERSUS PERCENTAGE AIR CURVES FOR CABLES AT VARIOUS OPERATING AND INSTALLATION TEMPERATURES

more particularly with the development of a means to prevent or compensate for them regardless of cause. A complete study of reservoir use should, however, include some discussion of the characteristics of jointed cable systems.

Initially, all cable contains a certain percentage of air, the amount varying with the method and materials of manufacture. If the temperature of installation of the cable is less than that at the factory when sealing is done, the percentage may be increased by the inflow of air when caps are broken. If the installation temperature is greater than that at the factory, a readjustment will take place in such a way as to make the pressure and volume of the initial mass of air correspond to the temperature of installation. In this connection it might be well to note that if cable were sealed at a lower temperature than installation best results would be obtained, for then compound will be lost rather than air taken in. Pressure-percentage air curves for various operating and installation temperatures are shown in Fig. (2). The author's derivations of equations for these are given in the box on page 1031. Graphs similar to these were first

FIG. 3—TYPE OF OIL RESERVOIR USED ON 27-KV. CABLE JOINTS

presented to the A.I.E.E. by C. F. Hanson.[1] Curves above the atmospheric line indicate temperatures of operation higher than those of installation; the greater this difference the higher the curve. In the case of the curve below atmospheric the reverse is true.

Small percentage of air cannot compensate for expansion or contraction of the compound without extreme pressure changes. This is indicated by the shapes of the left ends of the curves. In actual practice these curves are shifted considerably by the action of certain indeterminate factors—for example, those tending to lower curves—that is, increase vacua:

1. Working cable into ducts causes permanent sets in lead sheath and thus increases percentage of air pocket.
2. Repeated expansion and contraction with temperature may also do this.
3. Cheese or "X" formation is accompanied by contraction in volume of compound. It matters little whether a void exists first and that cheese formation is incidental to ionization of this or whether it forms first; a contraction takes place irrespective of sequence.
4. Some have attributed dryness of old cable to the slow absorption of oil by paper fibers. This may or may not be an important item.

Those tending to raise curves—that is, increase pressure:

1. Opening joints when cable is under vacuum.
2. Pressure filling of joints.
3. Refilling joints. (This should preferably be done during cold weather.)

In most cable systems the void- or vacua-creating tendencies are by far the most important. The effect of these are very clearly treated in a paper by Mr. Del Mar.[2] After consideration of this and study of the curves of Fig. 2 it might appear that large percentages of air in the cable were to be preferred because of their pressure stabilization (a small percentage of either giving rise to vacua or accompanied by higher pressures and permanent sets which eventually would cause vacua). However, this is not the case. Large amounts of air—that is, air in fairly appreciable thickness—will ionize even at atmospheric or slightly higher pressures, when the gradients in the cable are quite low. On the other hand, small amounts, possibly finely divided, will not ionize, even under appreciable vacua at same gradient.[3]

Obviously the most desirable condition would be to

[1] Discussion of paper on "Effect of Internal Vacua," by Del Mar, A.I.E.E., 1926.

[2] Paper on "Effect of Internal Vacua," Del Mar, 1926.

FIG. 4—CABLE OIL RESERVOIR WITH EXPANDING DEVICE

Study of Pressure Variation with Temperature in Jointed Cable Systems

Let a be percentage of air by volume in cable at cable factory, temperature, 25 deg. C.
t_1 the temperature of installation
t_2 the temperature of operation
Let b be percentage of air by volume in cable at installation temperature
$(1-b)$ is percentage of compound
(Percentage expressed as decimal)

If the temperature coefficient of expansion of the compound is assumed to be 0.001, the change in the volume of the compound $= (1-b) \times 0.001 \times (t_2 - t_1)$

The volume of air is decreased by this amount and becomes $V_2 = b - (1-b) \times 0.001 \times (t_2 - t_1)$

(1) But for gases $pV = RT$

and $$p_2 = p_1 \times \frac{V_1 (t_2 \div 273)}{V_2 (t_1 \div 273)}$$

$$= p_1 \frac{273 \div t_2}{273 \div t_1} \times \frac{b}{b-(1-b) \times 0.001 \times (t_2 - t_1)}$$

This is a general expression and can be used for any changes of temperature—that is, $\div$ or $-$.

If the cable is sealed at the factory with a percentage of air at, say, 25 deg. C. and opened for winter installation at temperature t_1, air will enter the cable to compensate for contraction of the compound

$$b = a \div (1-a) \times 0.001 \times (25 - t_1)$$

This expression must be substituted in (1). Assuming $t_1 = 15$ deg. C. for winter installation,

$$b = a \div (1-a) \times 0.01$$

and $$p_2 = p_1 \times \frac{273 \div t_2}{273 \div 15} \times$$

$$\frac{a \div (1-a) \times 0.01}{a \div (1-a) \times 0.01 - 1 - a - (1-a)\ .01 \times .001\ (t_2 - 15)}$$

(2) $$p_2 = p_1 \times \frac{273 \div t_2}{273 \div 15} \times$$

$$\frac{0.99a \div 0.01}{0.99a \div 0.01 - (1 - 0.99a - 0.01) \times 0.001 \times (t_2 - 15)}$$

Now it is necessary to substitute values for t_2 depending on operating conditions, as for example, $t_2 = 40$ deg. C. for maximum load in summer and $t_2 = 20$ deg. C. for minimum operating temperature in winter.

Curves showing the $(p - a)$ variation are then drawn.

Summer Installation

If the cable is installed in summer at approximately 30 deg. C., the compound will flow from the cable making air at atmospheric pressure for temperature 30 deg. C. instead of 25 deg. C.

The percentage of air, $b = a - \frac{273 \div 30}{273 \div 25} = 1.017a$

(3) This value of b when substituted in (1) yields

$$p_2 = p_1 \times \frac{273 \div t_2}{273 \div 30} \times$$

$$\frac{1.017a}{1.017a - (1 - 1.017a) \times 0.001 \times (t_2 - 30)}$$

Curves drawn with $t_2 = 40$ deg. C. for maximum summer operation and $t_2 = 20$ deg. C. for minimum winter operating temperature are also drawn.

[3] See page 83 of book entitled "Electric Cables," by Del Mar.

have the relative volume of voids and air as low as possible and provide some means for pressure stabilization above atmospheric. This may be accomplished without the disadvantages mentioned by the use of a large volume of air in a sealed tank reservoir, partly filled with oil. The gas may or may not be under pressure. In this way the desirable features of a large percentage of air are

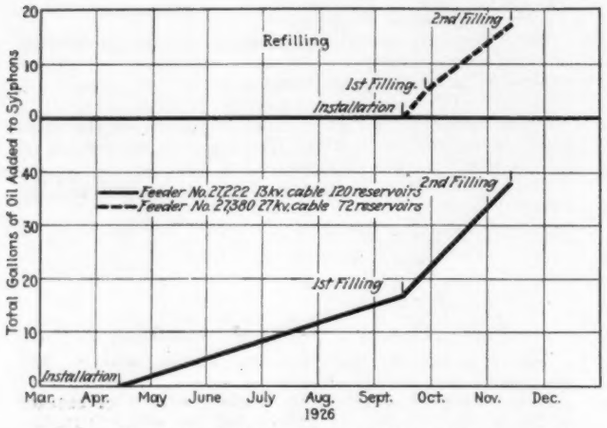


FIG. 5.—RECORD OF OIL RESERVOIR FILLING ON CABLE JOINTS

obtained without the incidental disadvantages. Equivalent and what we think better results may be obtained by the use of weighted collapsible reservoirs of the bellows type. It is recognized that these must be of suitable design. In this use of the device volume change is much more important than ability to operate at high pressure, relatively high frequency of movement or under heavy loads. These points have received due consideration in the design of equipment installed.

There are some inherent differences between these two methods. If the air bell type is left with air at atmospheric pressure, subsequent temperature changes may result in quite wide variation, above and below atmospheric. If the relative change is to be limited, the initial pressure must be quite high. This, too, has disadvantages. Then again, with air, there is danger of condensation of moisture, resulting in oil impairment, possibility of getting air into the cable system, need for gages to determine oil level, etc. On the other hand, with a weighted bellows a constant pressure somewhat above atmospheric is insured at all times. No air is in contact with the oil, visual inspection of height gives an indication of oil content, it is easily filled and occupies less space than the air dome type. High internal pressures are not considered necessary either for normal operation of cable or for reimpregnation of old cable. The latter takes place slowly and does not yield very readily to acceleration by the application of pressure.

The first extensive installations of reservoirs on the system were not intended to serve as the flexible part of the cable system, allowing for change in volume with that of temperature, but rather to maintain the pressure above atmospheric throughout the cable and to supply good oil to cable that had either been poorly impregnated at the factory or that developed voids and dried out subsequently. In other words, the prime purpose was to rejuvenate old cable. About 50 miles of old (1920-22) 3-250,000-circ.-mil $\frac{17 \times 11}{64}$ paper and lead cable which had previously operated at 13 kv. was being summoned into use at 27 kv. In some cases duct limitations prevented using larger cable. For the most part, however, it was considered justifiable economically to get as much use of cable as possible (removing after failure) rather than to make a reinstallation at the start. The 135-95-kv. direct-current (conductor to conductor and conductor to ground) test, which was considered necessary to insure against the occurrence of operating failures, gave rise to a great number of test failures on a few feeders. In each case examination indicated that a lack of compound was the contributing factor. Having in mind the results of previous experiments on migration, it was decided to install reservoirs on 25 of the 120 joints of one feeder in the hope that the thin oil with which they were filled would renew the life of the old cable. The results were most gratifying.

During the next few months all failures occurred in sections remote from oil-filled joints. The experiment was complete. The feeder was then operated at 13 kv. for six months, during which time all joints were equipped. Following this, testing prior to 27-kv. operation was resumed. Several failures 40 to 100 ft. from joints resulted. Oil was found 20 to 40 ft. back from joints. Finally the feeder passed the test and was put into operation. It has since—that is, for the past fourteen months—operated without any trouble. It has been out, tested and put back on the system without the usual series of failures. This behavior is to be contrasted with that previously obtained when the feeder could not be operated at 27 kv. Similar results have been secured with the feeders of the same type and on one containing old (1923—dry, with cheese formation) cable $\frac{20 \times 10}{64}$ on which the manufacturer suggested that reservoirs be installed.

The accompanying graphs indicate that quite appreciable amounts of oil enter cable. The average per 260-ft. section is approximately ½ qt. per six-month period. Fig. 6 shows very clearly the effect of altitude variation. By far the greatest amounts of oil enter at upper levels. To date there has been no noticeable inflow of oil to reservoirs at low points.

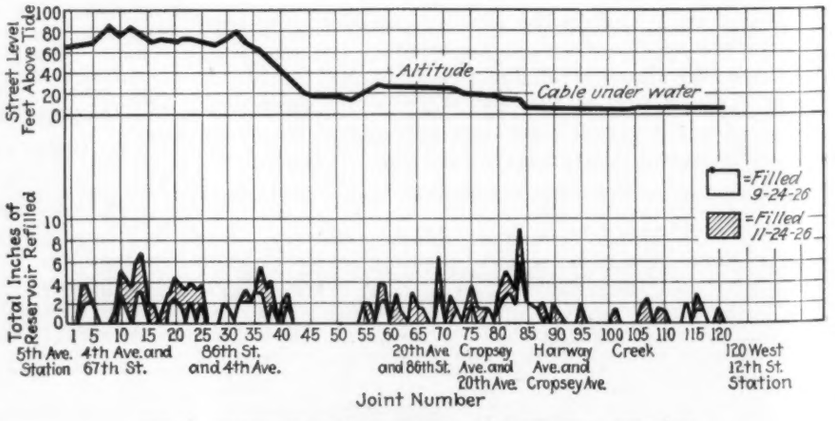


FIG. 6.—RECORD OF FILLING CABLE OIL RESERVOIRS, SHOWING EFFECT OF ALTITUDE VARIATION

No provision has been made to facilitate or create a tendency for movement of air in cable toward reservoirs

or traps. With good cable, which is well saturated, this is not a matter of much concern. In the case of old cable containing air it is felt that the normal variation in the level of cable will be sufficient to provide for such movement.

Details of Installations

The first collapsible reservoirs installed on the 27-kv. system were screwed directly to joint nipples. A 15-lb. weight was used to aid collapse. This set-up very frequently necessitated reracking the cable, made it necessary to equip each joint with one bellows and, since these could not always be kept in a vertical position, gave rise to appreciable stresses in the sheath due to the eccentric forces produced. It was soon realized that some other method must be developed. Installations similar to those in Fig. 8 resulted. A bracket in an unused upper corner of a manhole supports the weighted reservoir filled with oil. Connection is then made from this to as many joints as it is felt safe to bring to a common oil source. Standard brass fittings, reducers, petcocks, etc., and $\frac{3}{8}$-in. copper tubing are used in the accomplishment of this. When multiple connections are made, no two joints on feeders to the same substation are piped to a common reservoir. In all cases the tubing has been made to slope downward from the reservoir to the lowest joint in order to prevent trapping air along the line. The 30-lb. lead disk weights develop approximately $\frac{1}{2}$ lb. per square inch pressure within the bellows. Due to this and the static head of oil in the pipe line the pressure within the joints is of the order of 2 lb. per square inch. This is considered ample both for rejuvenation and detection of leaks.

Failure in a joint usually develops enough pressure to "blow up" the sleeve. When this pressure is applied to a reservoir, due to the large area on which this may act, very large forces are developed. These usually expand the bellows and blow out the ends or, if such motion is opposed, may rupture the constraining parts. In addition to this, if one joint of a cascade or parallel-connected group should fail, internal pressure developed might lead to further trouble in adjacent joints. In order to prevent such action a check valve was developed for use in each joint nipple. It consists of an "alemite" fitting with the spring removed and so is nothing more than a steel ball check. This is normally open and allows slow passage of oil in and out of the joint. The slightest "sudden pressure" will, however, seal it and prevent relief at the bellows or cause damage to adjacent joints.

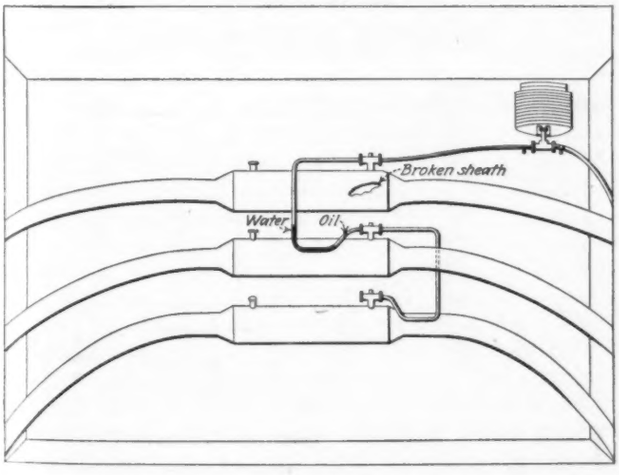


FIG. 7—INSTALLATION OF RESERVOIR FOR CABLES UNDER WATER

In the more recent installations plugs are provided at the tops of the reservoirs to allow for removal of small amounts of trapped air which may be introduced when refilling through the auxiliary "alemite-fitted" opening to the reservoir system. Inspection to determine the need for such refilling or draining (the latter may eventually be necessary) will be made at intervals of four to six months.

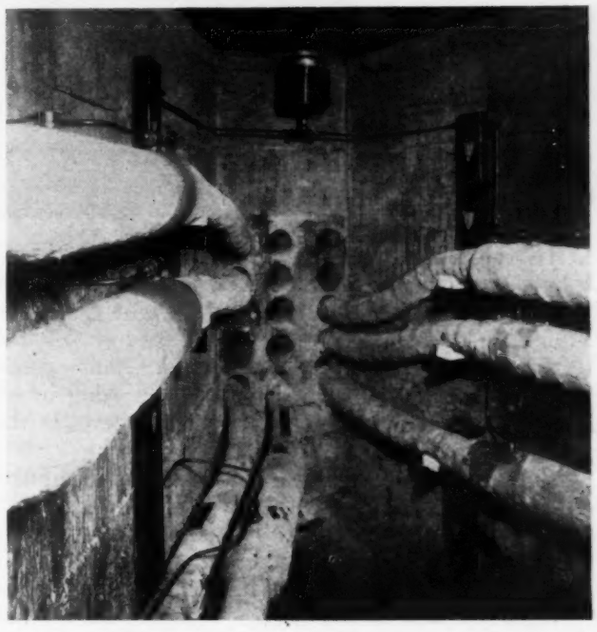


FIG. 8—METHOD OF INSTALLING RESERVOIR IN CABLE MANHOLE

The use of multiple or cascade connections of joints may be objectionable in manholes that are likely to be filled with water inasmuch as rupture of a joint sleeve at an upper level might allow water to enter the lower joints. This may be taken care of by the use of individual pipes from the joints to a common header or by putting slight loops in the tubing, as indicated in Fig. 7.

Future Installations

Authorization has been obtained to equip all of the 50 miles of 13-kv. cable operating at 27 kv. It is expected that this will gradually be extended to cover all 27-kv. cable. When installed, these oil-filled reservoirs should not only reimpregnate cable but improve joints, reduce cost of refilling and improve operating characteristics of feeders.

Three feeders to an alternating-current network are being installed at the present time. The importance of these can hardly be overestimated, hence the use of the very best cable and installation and jointing methods of the highest order. These joints will be oil filled and fitted with bellows type reservoirs. It is expected that, with the assurance of a well-saturated and filled cable and joint system under constant pressure slightly above atmospheric, very satisfactory results will be obtained. The use of fairly light compounds in the cable will facilitate transmission of pressure through the cable to the reservoirs. It may, at the same time, allow an appreciable oil flow due to static head. This will be compensated for by draining and filling the reservoir at regular intervals.

In concluding, it may be said that a system has been developed and installed that is highly satisfactory not only for reimpregnation of old cable but also for im-

proving the operating characteristics of any jointed cable systems. It is a cable user's response to manufacturers questioning pressure conditions after installation and constitutes one part of what may eventually be the continual use of reservoirs on cable from the time of completion of the leading operation.

Supervisory System Saves Transformer

By O. M. Ward
Assistant Electrical Engineer Electric Distribution Department, Milwaukee Electric Railway & Light Company, Milwaukee, Wis.

THE value of supervisory control was demonstrated by a recent rather unusual experience on the system of the Milwaukee Electric Railway & Light Company. In this case the control system very probably saved a 10,000-kva. transformer from burning out. This experience also emphasized the potential dangers lying in oil gages that show anything but the actual oil level in the transformer.

A short distance beyond the northwest limits of the city of Milwaukee is a 132/26.4-kv. transformer bank, consisting of three single-phase, 10,000-kva. transformers and several outgoing 26.4-kv. lines. This substation is controlled from the load dispatcher's office by means of a relay-type supervisory control system. During the early morning hours one day the load dispatcher received an intermittent indication that a transformer was overheated at this substation. It is the practice to have trouble men take care of emergency switching and inspection of unattended substations, and a trouble man was dispatched to this substation, with instructions to examine the transformers. After making an inspection of the equipment the trouble man reported that the transformers were not hot. The intermittent alarm which the load dispatcher had received had ceased altogether by this time, and it was presumed that the supervisory system was in error.

A short time later, however, indication was again given of excessive transformer temperature. This time the indication was continuous. One of the regular substation maintenance men, who was then ordered out, found the thermometer of one 10,000-kva. transformer indicating approximately 75 deg. C. This is the temperature at which alarm is given.

Fortunately this occurred during a light-load period, and the transformer bank could be spared without inconvenience. Upon investigating the cause for the high temperature, it was found that the oil in this transformer was low, although the gage showed about 2½ in. of oil in the conservator tank. All of these transformers are connected through valves to an oil storage tank buried in the ground. The drain valve on this particular transformer had developed a slow leak, and approximately 14 bbl. had run into the storage tank. This lowered the oil in the transformer to a point just below the top opening of the cooling radiators, thus cutting off oil circulation. After filling the transformer to the proper level, the bank was put back in service apparently undamaged.

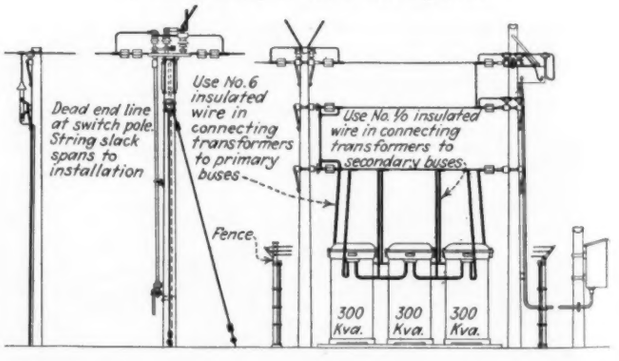
The connection between the conservator and main transformer tanks of this installation was so constructed that about 3 in. of oil in the conservator tank could not be drained into the main tank. The oil gage extends to within approximately ½ in. of the bottom of the conservator tank. This resulted in a false indication of the transformer oil level. Approximately 2½ in. has now been blanked off at the bottom of the gage. In order to guard against again losing oil, the connections in the drain pipes leading from the transformers have also been blocked off.

If this low oil condition had existed at a fully automatic substation without remote indication, the probabilities are that a burned-out transformer would have been the first alarm of unusual conditions. Even in an attended substation it is doubtful whether the operator would have discovered the trouble before serious damage resulted unless, of course, there was a high-temperature alarm in service. Feeling the transformer radiator when the oil level is low gives no indication of the transformer temperature, because there is no oil circulation through the radiators. The lower part of the main transformer tank, under these conditions, is also fairly cool. That is what fooled the trouble man who made the first inspection.

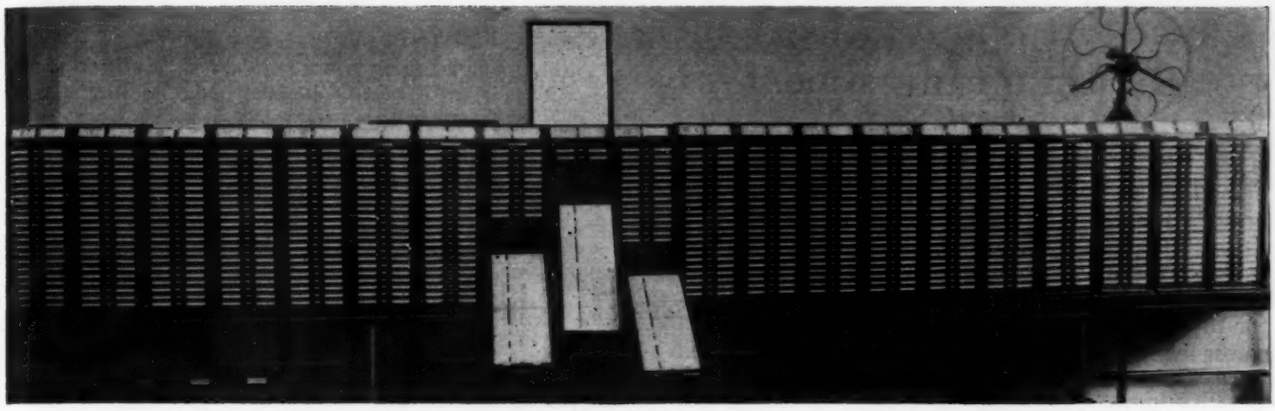
The supervisory control system for this substation has been in service about one year. Its operation has been highly satisfactory. There have been a number of instances where the 26.4-kv. lines feeding out of the substation have opened automatically due to lightning surges and other causes. The supervisory control has functioned properly in all cases. On one occasion when an intentional ground was put on a spare conductor in the control cable (the intentional ground was for test purposes), a conductor on one of the 26.4-kv. lines was accidentally grounded by the boom of a steam shovel working on the road adjacent to the line. The supervisory relays were thrown out of step and the set jammed. The load dispatcher simply had to press the "reset" button and remote operation was successfully resumed.

General 6,900-Volt Transformer Installation

Standards of West Penn System


Dead end line at switch pole. String slack spans to installation
Use No. 6 insulated wire in connecting transformers to primary buses
Use No. 1/0 insulated wire in connecting transformers to secondary buses
Fence
300 Kva.
300 Kva.
300 Kva.

THE above illustration gives the relative location of various equipment when two or more transformers are necessary and is not a construction drawing. Where pole-top switch must be placed more than one span from transformer installation, the relative location of pole-top switch and lightning arresters may be interchanged. Place a strip of 2-in. copper ribbon under transformers to ground cases and connect ribbon to ground rod with No. 6 copper wire. Steps may be used below 7-ft. point when poles are within a standard transformer fence.



ACCESSIBILITY AND REDUCED SPACE REQUIREMENTS ARE FEATURES OF CO-ORDINATED METER RECORD SYSTEM
The framed card above the file case offers color tab identification of periodic test assignments.

All Meter Records Combined in Unit File

Erie County Electric Company can answer practically any question about any instrument in fifteen seconds through the use of co-ordinated dual card system

By Bradley M. Smith
Meter Superintendent Erie County Electric Company

FIFTEEN seconds is a mighty short time when a person has to hunt information for some one at the other end of the phone. Yet in this time or less the meter department of the Erie County Electric Company can answer anything anyone wants to know about any of the 23,000 meters it owns.

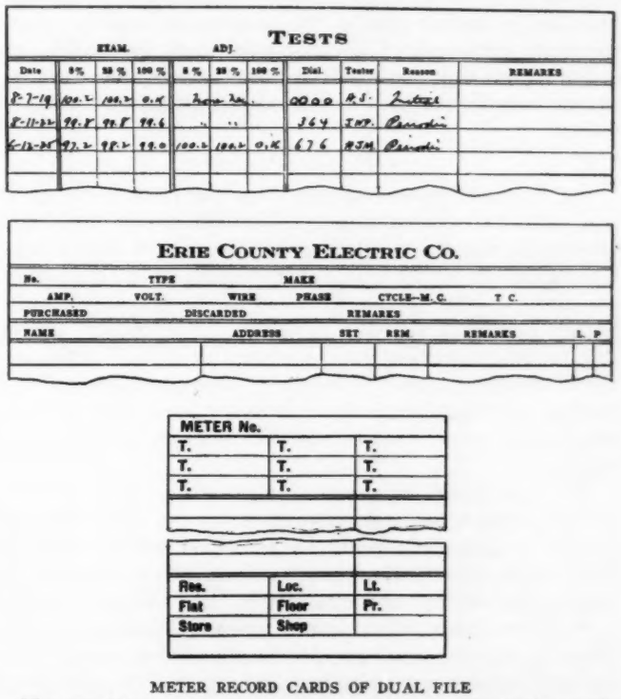
To secure such information most utility companies require at least three distinct records: (1) A record of meters, filed by meter number; (2) a street address or geographical record; (3) a test record.

One combined meter record that would tell everything about its meters had been hoped for by the Erie County Electric Company for years. It would have to be a numerical file and a geographical file, and it would have to contain complete test information. The present system not only combines these three records, but it is more economical in space, in time and in labor than the old separate card records and can be applied with possible modifications to meter records everywhere, as well as to other public utility files.

The record is visible. Each card is placed in a pocket, protected by a transparent tip, and projects ¼ in. beyond the card above it. This visible-record principle is very generally understood and is quite widely used. There are two distinct cards in the record, and usually there is one of each card in each visible pocket. The numerical meter records are kept on 6x4-in. cards and filed by manufacturer's number. This number is typed on the lower edge of the card so as to be visible when the card is placed in the pocket. The meter size is also typed in this visible position. The street address record is kept on a card 4x2¾ in. in size, which fits into the left side of each pocket. The cards are filed in numerical order according to streets. These two cards, although in the same pocket, have absolutely nothing to do with each other. There is a dual use of each filing space, which enables two former distinct files to be concentrated into one.

On the back of the numerical meter card are spaces for entering test information. Test data are entered merely by bending the card forward and downward, which brings the spaces on the card into writing position.

The time at which tests are to be made is controlled by colored signals, fitting into the transparent projecting tip of the pockets. There is a test signal for every meter in service. Different colored signals represent different years. Different markings on the signals show whether the testing is a one-man or a two-man job, or whether special testing apparatus is necessary. These signals also show disconnected or idle meters or meters in stock, and by their color they show how long any meter has been disconnected or idle or in stock. In a frame on the wall over the cabinets is a signal chart in colors, showing what each signal means.



METER RECORD CARDS OF DUAL FILE
The numerical meter record card is filed according to the manufacturer's number and carries test data on the reverse side. The smaller card is filed independently of the larger one, but in the same pockets, and may be located alphabetically and numerically by streets and numbers.

Where there were formerly 69,000 cards, in three separate files, there are now only 23,000 visible pockets needed for the entire meter story of the Erie County Electric Company.

Capacitors Show 40 Per Cent Return on Investment

By H. M. Jalonack
Transformer Specialist General Electric Company

THE power and lighting service used by a large utility-supplied industrial plant was derived from a single bank of transformers, but because of the poor power factor and fluctuating power demand, this arrangement was not satisfactory. It was decided that lighting for the factory buildings should be segregated from the power load and supplied by separate transformers from a regulated circuit, allowing the power factor problem to be settled in the most economical way.

Billing in this instance was based on kilowatt-hour consumption plus a demand charge based on either the kilowatt demand or 80 per cent of the kilovolt-ampere demand, the greater of the two being used. The existing power factor was approximately 65 per cent and the demand 2,000 kva. Approximately 550 kva. of corrective equipment would have been required to raise this power factor to 80 per cent.

It was proposed that the power factor be raised from 65 per cent to 80 per cent in order to secure the minimum billing, and the use of two capacitors of 240 and 300 kva. respectively was suggested. In addition to economy of operation, absence of moving parts and low maintenance costs, an injury to one part of the equipment does not disable the complete installation, it being possible to operate either one of the capacitors separately. It is also possible to operate one of the equipments with some of the units removed. Capacitor equipment is flexible, as only enough capacity need be purchased to take care of present requirements. No special foundations are required.

Economic Factors

On the basis of consumption for the previous year, it was estimated that a saving of $3,800 might have been effected in the demand billing had the power factor been maintained at 80 per cent. A reduction in kilowatt-hour consumption due to the operation of the transformers at higher power factor was expected. The annual saving due to this reduction was estimated at $183. Although there would be other economies, such as reduced fixed charges on transformer bank capacity, etc., only the two mentioned, which totaled $4,063 per year, were considered.

The operating expenses of the equipment needed to produce this result were computed on the basis that the capacitor equipment could be increased with growth of load, so that only the capacity installation required to obtain the saving was considered. A 540-kva., 2,300-volt, three-phase, 60-cycle equipment, consisting of one 300-kva. capacitor and one 240-kva. capacitor, would have an approximate net price installed of $8,500. The total losses would be $\frac{1}{4}$ of 1 per cent. The operating expenses would be as follows:

Annual demand charges: 540 (kva.) × 0.0025 ($\frac{1}{4}$ of 1 per cent losses) × $1 (demand charge) × 12 (months)		$16.20
Annual energy charges: 300 (days) × 9 (hours per day) × 540 (kva.) × 0.0025 ($\frac{1}{4}$ of 1 per cent losses) × 0.0075 (charge per kw.-hr.)		27.36
Annual depreciation and maintenance: 0.07 × 8,500		595.00
(Interest is not included, as the calculation is designed to show the return on the investment.)		
Operating cost		$638.56
Gross saving per year	$4,063	
Operating cost per year	639	
Net saving per year	$3,424	

The investment is $8,500. The annual return on it is 3,424 ÷ 8,500 × 100 per cent = 40.3 per cent.

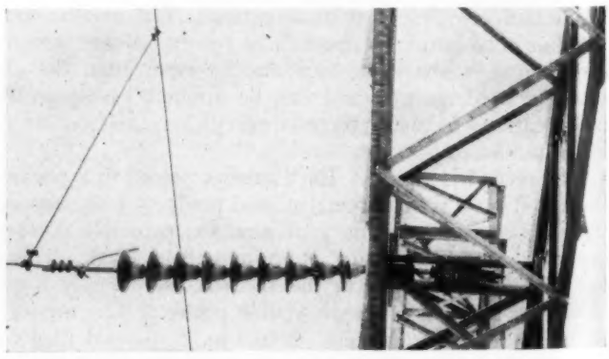
Although it was known that the average power factor was 65 per cent, it was decided to make additional tests on the plant before the actual decision was made. Tests run for several days produced the following results:

Volts	Amp.	Kw.	Kva.	Power Factor	Condenser Capacity Required	Remarks
2,220	520	1,296	2,019	64.2	583	Day load
2,210	520	1,375	1,990	69.0	410	
2,210	547	1,440	2,090	68.9	432	
2,210	540	1,410	2,080	67.7	472	
2,240	522	1,345	2,022	66.4	511	Night load
2,360	240	544	981	55.4	407	Noon
2,438	165	374	696	53.7	299	Sunday

This tabulation indicated that under the worst conditions 583 kva. would be required. It was decided to install two 300-kva. equipments. These equipments are specified for direct operation at 2,300 volts, three-phase, 60 cycles. Each unit is complete with a circuit breaker, discharge coils, racks and individual capacitor units. Leads run directly from the main 2,300-volt bus through disconnects to the floor below, where the switchboard operator has control of the power factor at all times and can put in or take out of service the necessary corrective capacity. On the basis of the preliminary figures, it is estimated that the equipment will pay for itself in $2\frac{1}{2}$ years.

Spring Keeps Flexible Bus Under Tension

FOR the past three years the Southern Sierras Power Company has been using coiled springs, installed in the manner shown in the accompanying illustration, to keep a tension on high-tension buses. At its San Bernardino, Cal., substation a spring made of $\frac{9}{16}$-in. spring steel formed into a helix with an outside diameter of 3 in. and a free length of $8\frac{3}{16}$ in. was used. Such a spring, when compressed to the limit, should exert a pressure of 2,300 lb. and was designed so that when compressed to a length of $7\frac{3}{16}$ in. it would exert a tension of 1,000 lb. on the conductor. Checks were made with a dynamometer at the time of installing the first few springs and they were found to check remarkably close with the specifications.



FLEXIBLE HIGH-TENSION BUS CONDUCTORS KEPT UNDER 1,000-LB. TENSION BY SPRINGS

These springs are a material help in keeping flexible bus conductors in a good looking and safe working condition and also do much to relieve possible strains and shocks.

Effect of Inductive Coupling on

Balanced Relay Operation

System tests and their results. Effect of coupling is most pronounced on ground relays. Proper protection of lines emphasized

By J. W. HANSON

Assistant Engineer Columbia Engineering & Management Corporation, Cincinnati, Ohio

WITH the addition of the Columbia power station to the Cincinnati system it became necessary to provide several more substations on the 66-kv. system. Among others, the Hartwell Terminal substation was added at a point about 1½ miles from the Elmwood substation, between the two original lines. When this station was added, the original lines, Nos. 1 and 2, were cut and brought into the Hartwell substation. The logical method of constructing then appeared to be to bring the new lines in on two-circuit towers as shown in Fig. 1. With this arrangement lines Nos. 661 and 662 are of approximately equal length and apparently could be protected by a balanced-relay scheme. Consequently this type of line and relaying was employed, as shown in accompanying illustrations.

The line current transformer connections are such that, with current in the same direction in both lines, the current in the phase relays will be the vector differences of the currents in the phases of the two lines—that is, current in phase 1 relays is the vector difference of the currents in phase 1 of line No. 661 and in phase 1 of line No. 662, and similarly currents in phases 2 and 3 are their vector differences. Also, the current through the ground relays will be the vector sum of these three-phase vector differences. With current in the two lines flowing in opposite directions, the currents in the relays will, of course, be the vector sum of the currents in the lines.

The potential elements are so connected that, with a current flowing through the relay circuit, the potential elements of the two relays in any phase or in the ground circuit will take opposite directions. They are so connected that, if excess current is flowing out from the bus over one line, the relay that trips this line will be the one the potential element of which will close its con-

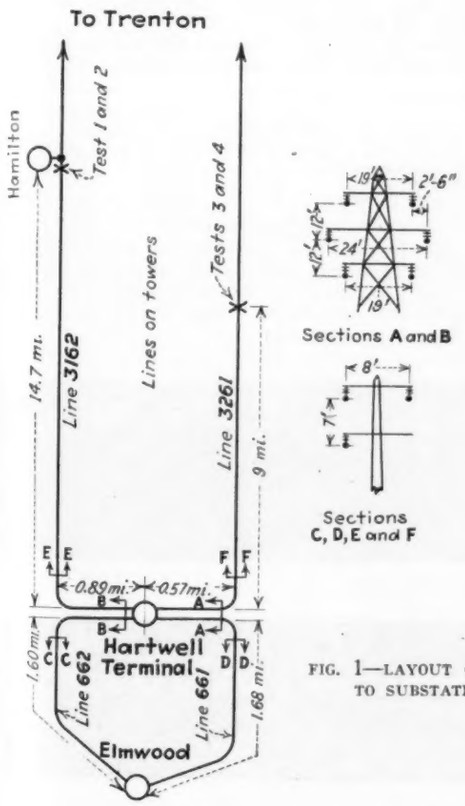


FIG. 1—LAYOUT OF LINES TO SUBSTATIONS

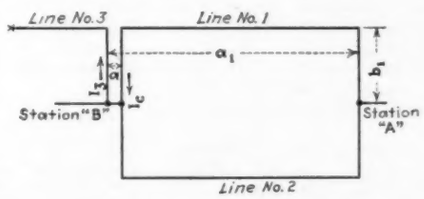


FIG. 2—LINES NOS. 1 AND 2 BETWEEN STATIONS "A" AND "B"

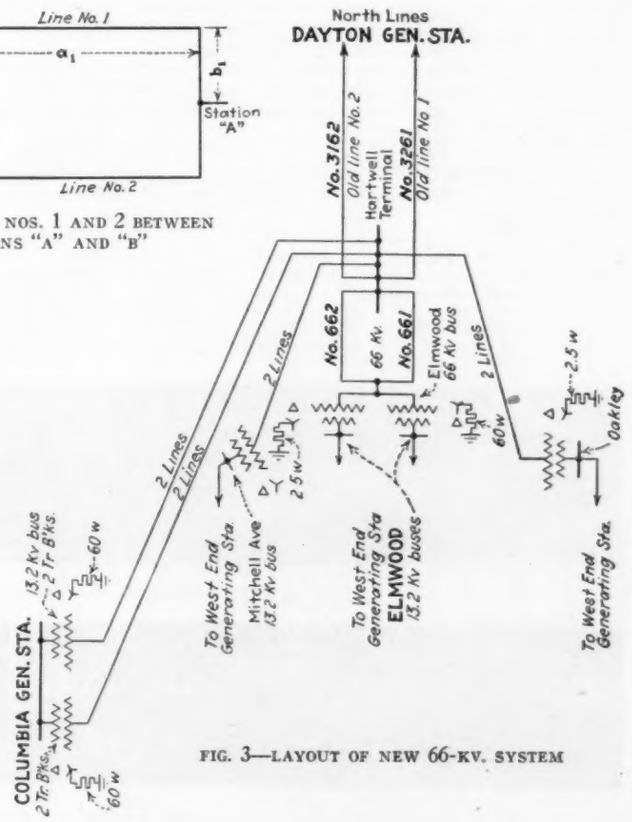


FIG. 3—LAYOUT OF NEW 66-KV. SYSTEM

FIG. 4—TEST NO. 1. GROUND ON ONE PHASE OF LINE 3162

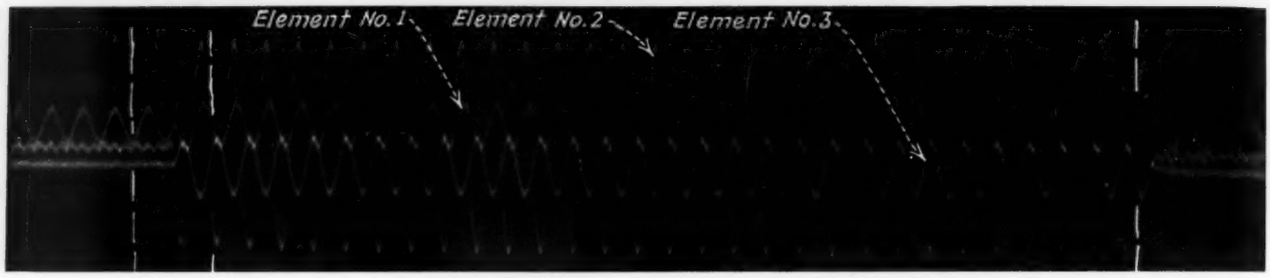


FIG. 5—TEST NO. 2. GROUND ON ONE PHASE OF LINE 3162

Test No. 1.—Line No. 3162 was grounded at Hamilton. The oil switch connecting this line to the Hartwell Terminal 66-kv. bus was then closed. The relays on line No. 3162 were allowed to clear the fault. An oscillogram was taken showing current in lines Nos. 661-662 and 3162.

Element	Current Previous to Fault (Amp.)	Current During Fault (Amp.) First Cycle	Last Cycle
1—Circuit No. 661, single phase	57	85	82
2—Circuit No. 662, single phase	59	121	115
3—Circuit No. 3162, single phase	0	368	328

At the start of the fault, it may be noted on the oscillograms, current in lines Nos. 661 and 662 reversed. Previous to the fault the power is from Hartwell Terminal to Elmwood substation; during the fault the power is from Elmwood substation to the fault through Hartwell Terminal substation. Previous to this fault the currents in the lines Nos. 661 and 662 were practically equal, indicating that under normal operation the lines are of equal impedance. During this fault the coupling effect with line No. 3162 produced the unbalance of 40 per cent between the lines Nos. 661 and 662.

Test No. 2.—Same as test No. 1, except that the oscillogram was taken showing current in phase 1 of line No. 661, voltage on line No. 661 ground relay and current through line No. 661 ground relay:

Element	Previous to Fault	During Fault First Cycle	Last Cycle
1—Current in 661, single phase	64 amp.	86 amp.	72 amp.
2—Volts on ground relay	2.2 volts	68 volts	65 volt
3—Current through ground relay	0 amp.	0.833 amp.	0.733 amp.

The relay potential connections are shown in Fig. 9*a*. Current through the ground relay was 180 deg. out of phase with the relay potential. The internal relay connections are such that the ground relay will close under this condition. This relay, then, with a fault on line No. 3162 trips out line No. 661.

Test No. 3.—Same as test No. 2, except that line No. 3261 was grounded instead of line No. 3162.

Element	Previous to Fault	During Fault First Cycle	Last Cycle
1—Current in 661, single phase	57 amp.	194 amp.	149 amp.
2—Volts on ground relay	2 volts	87 volts	74 volts
3—Current through ground relay	0 amp.	4.33 amp.	3.52 amp.

The potential here was the same as that of test 2. The current through the ground relay was in phase with the applied potential, and this relay remained open. The relay on line No. 662 closes and trips out that line.

Test No. 4.—Same as Test No. 3, except that the oscillogram was taken showing current in lines Nos. 661, 662 and 3261.

Element	Current Previous to Fault (Amp.)	Current During Fault (Amp.) First Cycle	Last Cycle
1—Circuit No. 661, single phase	60	189	149
2—Circuit No. 662, single phase	56	92	74
3—Circuit No. 3261, single phase	0	1,070	945

In this case, line No. 661 was carrying the larger current. During the fault, the current in line No. 661 was twice the current in line No. 662. As shown on the oscillogram, there were equal currents in the two lines during normal conditions previous to the fault.

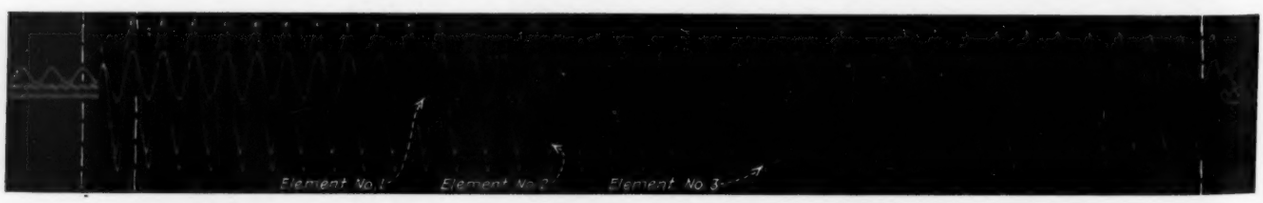


FIG. 6—TEST NO. 3. GROUND ON ONE PHASE OF LINE 3261

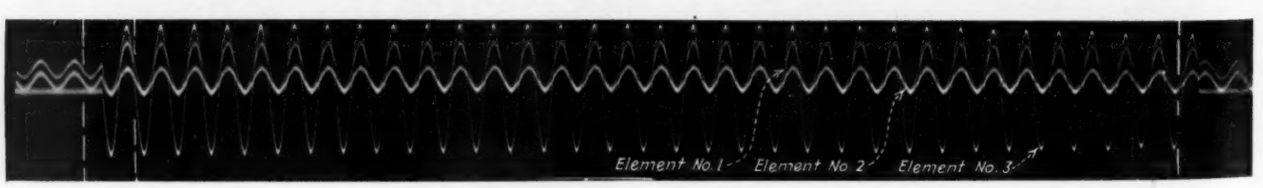


FIG. 7—TEST NO. 4. GROUND ON LINE 3261

tacts. The current and potential relations are represented in Fig. 8.

To make clear the operation of the protective system during a ground fault two examples are given:

Case 1. A Ground Fault Occurs on Line No. 661.—Under this condition excess current flows out from the bus over line No. 661, and the current elements in the two directional ground relays close. Also, the potential element on line No. 661 relay closes and trips out that line. The potential element of the relay on line No. 662 is opened. That trip circuit then remains open and line No. 662 remains in. With the same protection on the other end of the two lines, line No. 661 trips out in the same way at that end, and the faulty line is cleared. This is a normal case for which the protection was designed, and its operation is in every way correct.

Case 2. A Ground Fault Occurs on the System on Some Other Line Off the Hartwell Terminal Bus.—If, under this condition, there is sufficient unbalance of the fault current in the two lines, relay operation will occur. To make the operation of the protection clear under this condition, assume that the excess current flows in line No. 661. With the power flowing into the Hartwell bus to the fault, the relays at the other end of the two lines function as in Case 1, and line No. 661 opens at that end. At the Hartwell Terminal an excess current is feeding into the bus. This causes the relay that trips line No. 661 to open its potential element, and that which trips No. 662 to close its potential element. Then at the Hartwell Terminal end line No. 662 opens and service will be interrupted over both lines.

If the normal impedance of the two lines obtains during all fault conditions, Case 2 could not occur. However, on actual lines there may be sufficient variation in impedance during fault to give wrong relay operation due to the proximity of other lines carrying fault current and other minor causes. If the relay scheme utilizes ground relays, the proximity of other lines becomes a factor of considerable importance. Experience with the relaying of lines Nos. 661 and 662 showed that they were repeatedly tripped out when faults occurred on lines Nos. 3261 or 3162, the relay operation under this condition being that discussed under Case 2. The inductive coupling between the line in fault and lines Nos. 661 and 662 caused the variation from normal impedance of this pair of lines.

To illustrate the effect of fault current in adjacent circuit, take the two lines Nos. 1 and 2 in Fig. 2 and a third, No. 3, running parallel to one section of line No. 1. Lines Nos. 1 and 2 are identical and symmetrically built with respect to each other. If current I_3 flows in

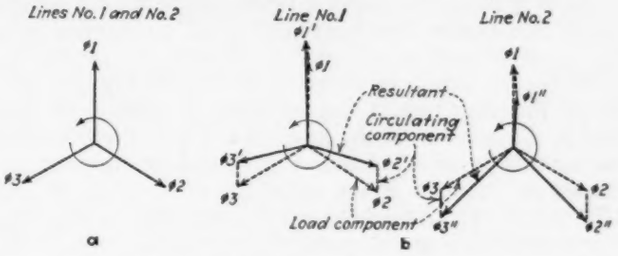


FIG. 8—VECTOR DIAGRAMS OF INDUCTIVE EFFECT BETWEEN PARALLEL LINES

line No. 3, there will be induced in the loops formed by the several phases of lines Nos. 1 and 2 a voltage 90 deg. out of phase with line No. 3 current. This voltage will depend on the difference in the number of lines of flux cutting the two sides of the loop. This voltage may be calculated by the formula:

$$E = 0.2794\, I_3\, l \log \frac{a'}{a} \text{ volts}$$

where I_3 is in amperes and l in miles.

In an actual application I_3 returns through ground, and consequently the voltage induced in the phase loops will be the difference of the voltages due to current in the conductor and that due to its image or ground return.

These voltages will be induced in each of the phases, the relative magnitude in each phase depending on the

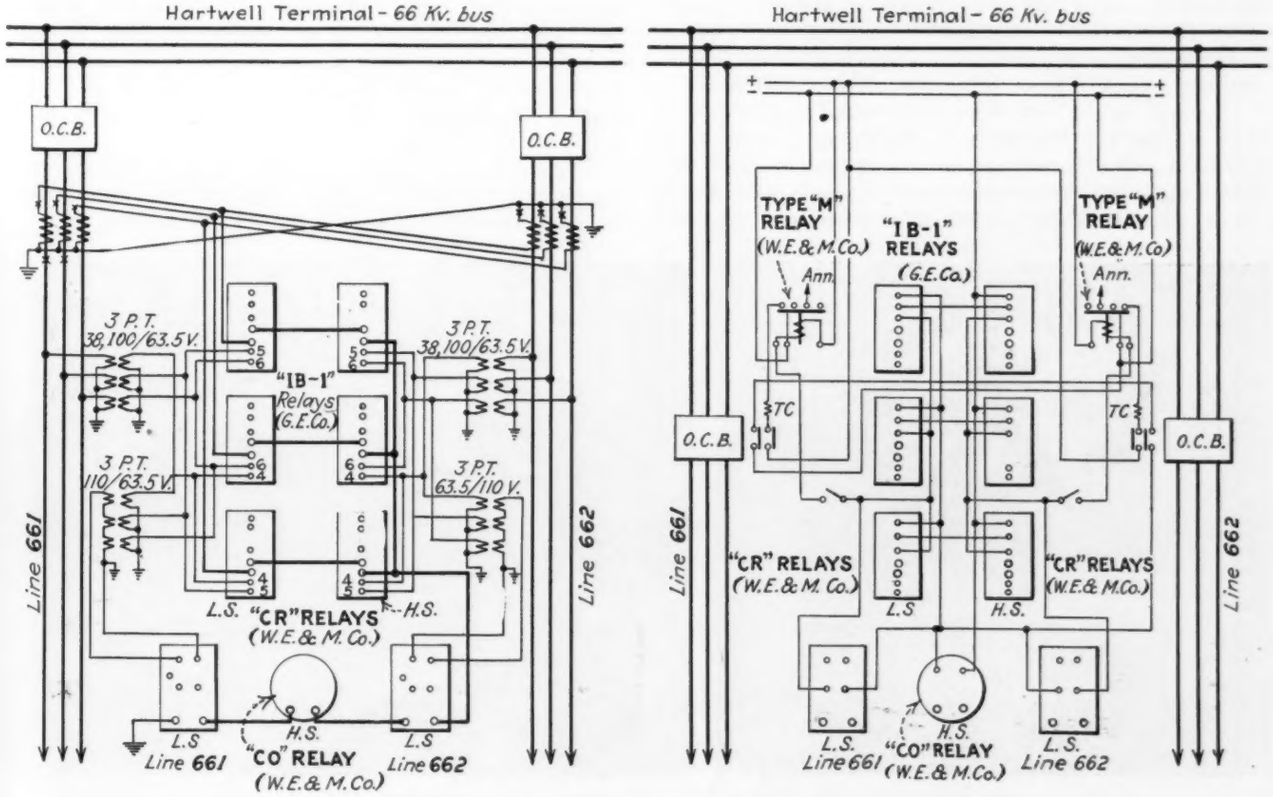


FIG. 9—RELAY DIAGRAMS SHOWING (A) POTENTIAL AND CURRENT CIRCUITS AND (B) TRIP CIRCUITS

relative value of the terms involving the logarithm of the distance ratios. The current which will circulate around the loops will be $E \div Z$, where E is the voltage induced and Z is the impedance of the loop to a current flowing around the loop, which may be termed the series impedance of the loop. If the reactance of the loop circuits is high, the loop currents will be approximately 180 deg. out of phase with I_3.

Assume there is no current in line No. 3 but that there is a normal power flow from Station "A" to Station "B"; then current will be assumed to flow in the phases of lines Nos. 1 and 2, as shown vectorially in Fig. 8*a*. If, under this condition, a current flows in phase 1 of line No. 3, the currents in the lines Nos. 1 and 2 will be the vector sum of the currents in Fig. 8*a* and the currents, I_c, caused to circulate in the three-phase loops due to I_3. The resultant currents are shown vertically in Fig. 8*b*. The vector differences of the various phase currents in the lines is in each phase twice the circulating component. Then, if these lines were protected by a relay scheme such as used on lines Nos. 661 and 662, the current through each phase relay would be equal to twice the circulating component, and the current in the ground relays would be the sum of the currents through the phase relays.

The magnitude of the circulating component depends on the voltage induced by I_3 and the series impedance of the loops. If the load components are exactly equal in the two lines, their effect on the reactance component of the series impedance of the loop is exactly equal and opposite on the two halves of the loop. Therefore, the series reactance of the loop circuits is due to the circulating component only.

System Tests and Their Results

To check the magnitude of these inductive effects, tests were made on the lines. It was desired that during the tests the system should be operating as nearly as possible under the normal conditions. During all the tests the 66-kv. system set-up was normal as shown in the system diagram, except that of lines Nos. 3162 and 3261.

Previous to the test these lines were opened at both ends so that the Dayton and Cincinnati systems were separated. The No. 1 phases of each of the lines Nos. 3162 and 3261 were grounded at the points indicated in Fig. 1. For each test one of these lines was connected to the Hartwell substation bus to produce the required fault condition.

The test results show that the variation from normal impedance lines Nos. 661 and 662 is dependent on the location of the fault—that is, it is dependent upon which line is affected by the inductive effect of the faulty line. As the effect of the inductive coupling will appear in all three phases, the ground current, being the sum of the phase differences, exceeds the difference that occurs in any one phase. The ground relays then are the relays most affected. Also, the ground relays operate as described previously as Case 2, and both lines are opened and service between the two stations is interrupted.

Conclusions

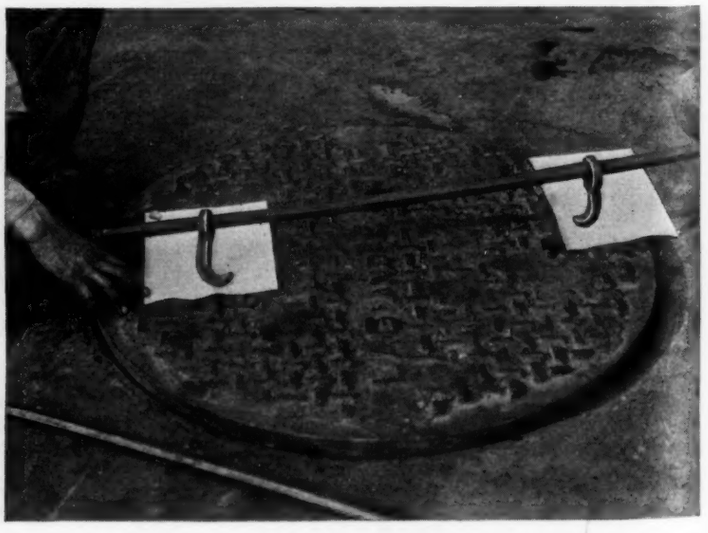
The tests clearly emphasize the importance of designing lines so that they may be properly protected. Where either current or power balance relay protection is to be applied, the inductive effects between the parallel lines, in case of trouble, should be considered very carefully. This, of course, is of much greater importance when ground relays are used. The most suitable construction for short overhead lines to be protected by balanced relays is to put both of the lines on the same tower.

Heavy Manhole Covers Can Be Lifted by One Man

DIFFICULTY of raising heavy manhole covers has led the Los Angeles Gas & Electric Corporation to adopt a design that permits the use of hooks and crowbars to raise the covers in the manner shown in the accompanying illustrations. Rectangular openings and round steel pins are cast in the cover so that the steel hooks shown may be inserted therein. A short steel bar is placed through eyes in the hooks and by using two light crowbars for levers one man can easily raise a 340-lb., 28-in. manhole cover with one quick motion. Two or three applications of the bars will throw the cover entirely clear of the hole. A short piece of manila rope is wedged into the cover openings to keep them from filling with dirt.

This method of raising manhole covers not only has the advantage that one man may raise a heavy cover but it has eliminated strained backs and mashed toes.

ONE MAN USING CROWBARS RAISES MANHOLE COVER WEIGHING 340 LB.



STEEL BAR PASSES THROUGH HOOKS WHICH FIT AROUND PINS IN MANHOLE COVER

Better Radio Broadcasting*

Regulatory efforts of Radio Commission directed toward reduced interference. Synchronization of transmitting stations offers solution to wave length allocation problem

By O. H. Caldwell

Federal Radio Commissioner for Eastern District

THE problem with which the radio commission has been struggling is essentially an engineering problem—that of fitting on 89 wave lengths some 700 broadcasting stations, big and little, so that there will be a minimum of interference among those stations as received on listeners' sets.

* * * *

Even under the best conditions we have far too many stations to accommodate on the wave bands available. As long as 700 stations are to be assigned places in the broadcasting band, there are bound to be heterodynes† under present methods, for the commission, against its better judgment, has been forced to locate stations too close together to avoid interference under conditions of maximum reception. That some heterodynes now exist cannot be denied, but the transient character of most of these, here tonight and gone tomorrow or gone even in the next hour, indicates that they result from distant stations wandering off their assigned channels and straying into the adjoining rights-of-way of the stations thus imposed upon.

With the help of the radio division of the Department of Commerce frequency measurement, observations are now being made on all broadcasting stations to see that they adhere to their wave lengths within the one-half kilocycle limit prescribed by the commission. Broadcasters who fail to hold their frequencies will find their licenses revoked and their stations shut down under the provision of the radio law. By this method the commission hopes to eliminate some of its excess of 700 stations.

"Why doesn't the commission in the same way simply shut down 300 or 400 of the unnecessary stations now on the air?"

The answer is that these 300 or 400 stations cannot be shut down summarily by refusing them licenses or revoking their permits to operate, even though that would be so manifestly in the public interest. A careful reading of the radio law of 1927 will show that that act gives to the commission no power to close down a single station which was licensed and operating prior to Feb. 23, 1927. Licenses can be revoked in the case of stations which disobey the provisions of the law or the regulations of the commission, but any easy method of providing needed relief for the listeners by simply wiping out a lot of the less desirable stations has not been legally possible.

With this avenue for relief closed, the commission has therefore so far worked out its solution along the line of duplication of waves and enforced time sharing, making assignments on the basis of stations' demonstrated past performance in serving the public. Even further sharing of time by stations will be imperative, it now appears.

Synchronization May Solve Interference Problem in Broadcasting

Another avenue for relief is presented by accurately synchronizing the frequencies of stations on the same channel, so that the only interference will be cross-talk and not heterodyning. Although the audible signal of a 500-watt station may under good average conditions be heard 100 to 200 miles, its carrier under the same conditions will cause heterodynes or "whistles" up to 1,000 miles.

If the frequencies of two stations can be brought into such close synchronism that the difference between their radio frequencies is less than an audible frequency, the former heterodyne will disappear. The stations can then safely be located closer together geographically up to a minimum distance where the program of one comes in loud enough to appear as "cross-talk" on the other.

This separation distance where noticeable cross-talk occurs between stations is from one-quarter to one-tenth of the separation distance at which heterodyning or "carrier-wave interaction" becomes objectionable. Hence if stations on the same frequency can be accurately synchronized, it will be possible to utilize our present channels manyfold more effectively and to eliminate heterodynes that now persist because of the close duplication of stations necessary on the same frequency channel.

Synchronizing by Wire, Radio and Matched Crystals

Three methods for station synchronization appear to promise excellent possibilities:

1. Wire control of two or more stations from a common source of radio frequency. This plan is being operated with success nightly between station W B Z, Springfield, Mass., and its auxiliary W B Z A, in Boston. a distance of 100 miles. These two stations operate on the 900-kilocycle channel at precisely the same frequency without heterodyning. Although they deliver the same program, their successful operation indicates the possibility of synchronizing stations further apart, at

**Excerpts from address before the American Institute of Electrical Engineers, New York City.*

†Heterodyning results from the slight difference in frequencies of two stations on the same channel. For example, on the 900-kilocycle channel, if one station is operating accurately at 900,000 cycles, and a second station within carrier-wave range is operating at 900,250 cycles, the listeners between and at a distance from both stations will hear a squeal which is the audible difference between the two frequencies—that is, a musical note of 250 cycles or about middle C on the piano.

"non-cross-talk" distances, and transmitting different programs. When further developed, this plan offers an economic solution of the very serious problem of chain-program operation, where twenty to forty channels are now sometimes tied up with an identical program. If such chain programs could be limited to one of two channels, obviously many channels now tied up would be freed for other services.

2. Radio synchronizing of stations. A receiving set is installed 6 to 10 miles away from the station to be synchronized. On this set the incoming carrier wave from the distant station on the same channel is picked up and transmitted by telephone to the station control room. By the zero-beat method the local station is synchronized with the distant station. Operation then continues without heterodyning, and this is accomplished under separations between stations which would produce terrific beats or howls if the ordinary method of approximate frequencies were employed. This plan is successfully employed by station W D R C at New Haven, Conn., to avoid a bad heterodyne that would otherwise occur from the 5,000-watt station W A I U on the same channel at Columbus, Ohio, which is only 500 miles distant.

3. Identical or matched crystals, maintained under standard temperature conditions at the two or more stations to be synchronized, offer another means of economizing wave areas. Manufacturers of crystal-control apparatus give assurance that they can now guarantee crystals so accurately matched that no audible heterodyne will result between stations so controlled. No broadcasting stations have so far been equipped in this way, but it is to be hoped that the method will be practically tried out by stations in the near future.

Appliance Survey Indicates Wide Use by Consumers

AN ANALYSIS of the electrical devices owned by the customers of the Elmira Water, Light & Railroad Company indicates a wide use of appliances. There are more electric irons used than there are electric consumers. More than 50 per cent of those receiving energy from this company are utilizing washing machines and vacuum cleaners. A survey made by the Elmira company indicated that 97 per cent of the gas and electric consumers received electric service. An outline of the survey was presented by F. H. Hill, vice-president of the company, at the annual meeting of the commercial section of the Empire State Gas and Electric Association.

Customers using electricity total 13,567 out of a total of 14,034 who receive either gas or electricity, or both, from this utility. The electric appliances installed numbered as shown in the table:

Irons	14,156	Ironing machines	127
Washing machines	7,619	Percolators	816
Ranges	141	Room heaters	534
Refrigerators	112	Sewing machine motors	142
Vacuum cleaners	7,444	Water pumps	81
Toasters	3,127	Grills	334
Curling irons	1,875	Heating pads	199

"By means of this survey," said Mr. Hill, "we shall know the equipment of each of our customers and the possibilities of our sales, and we shall then attempt a selling campaign to build up the domestic load."

Urges Standard Valuation of All Utilities*

Complete appraisal of properties of all companies except interstate railroads suggested by Public Service Commissioner

By WILLIAM A. PRENDERGAST
Chairman Public Service Commission of the State of New York

IT IS my opinion that the duty is now imposed upon the commissions to remove this question of valuation from the domain of political debate and that the National Association of Railroad and Utilities Commissioners should assume leadership in the undertaking. If it is not done, there is the greatest danger that the subject will be made a political issue, with results that no candid student of regulation believes will be determining and which will undoubtedly lead to greater confusion. If this question becomes a purely political one, it will surely be presented to the legislatures of the states for settlement and we shall have political judgment upon economic questions.

I offer this criticism of legislative dictum on a subject of this character because I do not believe that it can ever receive the necessary study from the legislative bodies, and we must all recognize the fact that the political instinct would prove the chief motivation in any decision which legislative bodies will render. This has been the result of such efforts throughout the entire history of the regulative theory.

It would, in my opinion, prove a great public boon if there were a general agreement among utility commissioners in respect to the treatment of valuation. Is it possible to accomplish this? The courts have prescribed certain principles, but this does not mean that a reasonable formula for the execution of those principles would not meet with general public acceptance and be sustained by the courts. There is no disagreement, or should be none, that it is the present fair value of the properties that is to be determined—that is, a fair value as of the time of the proceeding, or, if it were possible to make a valuation of all utilities, this value should be determined as of the time when it is made. How can present value be determined except by present prices, subject, of course, to the depreciation in the property, this to be fixed by competent examination? A new economic age has arrived. Let us consider our present problems in the light of present conditions.

IDEAL STATE OF REGULATION

I am inclined to believe that the main difficulty in arriving at a satisfactory basis for determining the "present fair value" of a property arises from the fact that in many cases the overheads and going values claimed by the companies are from any reasonable viewpoint generally claimed on a basis which is grossly excessive. It may be well within the facts to say that the size of such claimed values has done much to arouse opposition to the reproduction-cost theory. But these issues are susceptible of fair and adequate treatment. If these claims are considered by the commissions in the light of reasonableness and reduced to their proper size, and the decision fortified by convincing arguments, it is almost certain that the view of the commission will be sustained by the courts.

**Conclusions of an address before the annual convention of the National Association of Railroad and Utilities Commissioners at Dallas, Tex.*

Most of the reversals arise from the fact that these issues are either ignored or, if recognized, receive a consideration which is manifestly inadequate.

The ideal state of regulation would be the establishment of valuations for all companies with the necessary modifications of additions and withdrawals from time to time. In this way there would be a rate base which would be a continuing basis for such changes in rates as conditions warranted. Viewed from a practical standpoint, the task seems most difficult. But at the same time it is, in my judgment, one of the chief functions of regulation and therefore a problem which should be thoroughly mastered.

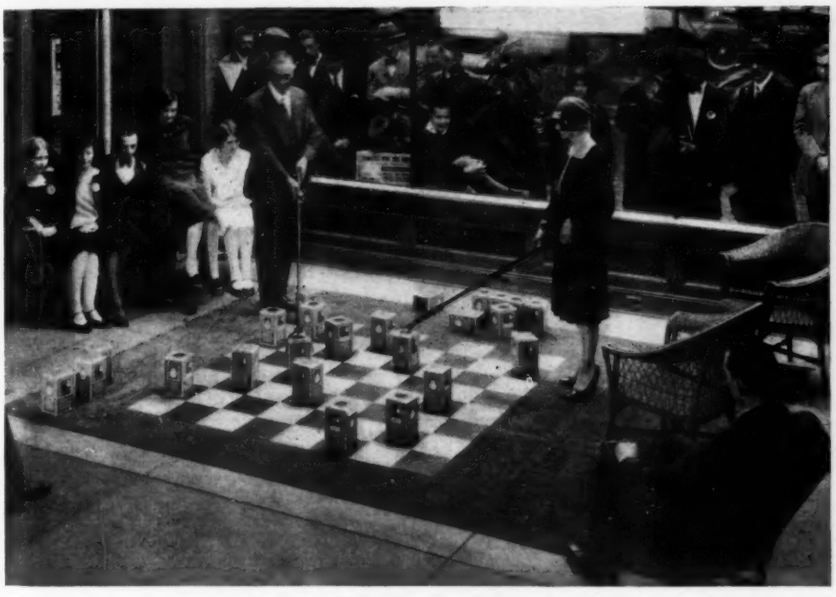
People generally suppose that with reports filed annually by the utilities it is simply a question of consulting these reports in order to fix rates. But the obstacle is that the fixed property values appearing on the books do not reflect the actual present values of the properties, and for that reason the reports do not serve the required purposes.

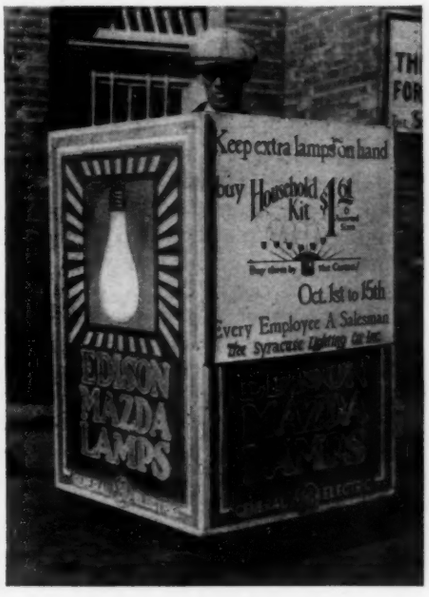
Shall there be undertaken a complete appraisal of all the properties of all the utilities excepting interstate railroads? This will require an immense expenditure. Will the states burden themselves with this expense? I could quote some instances which would discourage the mere suggestion of their doing so. If the work is to be undertaken, it would have to be done by the commissions through their own staffs, as the valuation of the railroads has been and is being done by the Interstate Commerce Commission. I wish to point out that this would be necessary, because I fear that there would be a demand on the part of the localities that they should participate in the work. This would undoubtedly then take the form of a valuation proceeding, with the consequent loss of time, which would be ruinous to the enterprise. Legislative sanction would be required for this work, and this would invite the problem of a legislative program of the principles on which the valuations should be based. I believe, however, that as a preliminary to any policy on this subject it is important that in every rate proceeding the commission should find a valuation. This being done, at least a beginning will be made in having the necessary data on which required changes may be based.

Sold 93,600 Lamps in Fifteen Days in Syracuse Campaign

MANY interesting ideas were utilized by the Syracuse (N. Y.) Lighting Company in its recent campaign for the sale of lighting kits to the consumers in that territory. A kit consisted of one 100-watt, three 60-watt and two 40-watt bulbs in a General Electric Edison Mazda package. The price was $1.61. Among the sales-producing devices utilized in this campaign were large illuminated signs on the company's building, attractive window displays, banners over the street, lettered cloth signs on company trucks and commercial cars, newspaper advertising and a direct canvass by practically every employee. Proper organization, co-ordination of effort and employee participation sold 93,600 lamps, totaling 5,616 kw.

A checker game between a local expert and any and all comers was instituted in the show window of the Syracuse commercial office. Announcements in the newspapers preceded the several days on which the games were played, and the morning of the first day saw a fascinated public standing four and five deep outside of the show window to watch the games. The board consisted of a linoleum floor covering of the proper checker proportions, and the lamp kits constituted the checker men. The successful challengers each received one of the kits as a reward for their skill.





LAMP KIT CHECKER GAME AIDS IN LIGHTING CAMPAIGN. AT RIGHT, SANDWICH MAN WHO ALSO SERVED

An analysis of the customers' utilization of lighting facilities indicated that approximately 12 per cent of the outlets in which there should have been lamps were empty, and a campaign to correct this shortcoming was planned and carried to a successful conclusion. The goal set approximated one bulb for each meter connected to the company's lines, and the campaign resulted in a total sale of 15,600 kits to approximately 10,000 purchasers. The lamp sales totaled 93,600. There are more than 57,000 meters connected.

Each employee received a ten-page book, and in soliciting orders for these lamp kits the purchaser signed a page as authority for charging the kit to his monthly bill. A complete book with the names of ten lamp kit purchasers was worth $2.50 to the industrious employee as a reward for his efforts.

A General Rule for Making Line Extensions

By R. E. Duffy
Chief of Water, Gas & Electric Department
Public Service Commission, Jefferson City, Mo.

THE equitable division of costs between utility and customer in the financing of line extensions has been the subject of much discussion and is more or less closely approached by the various schemes now in use. However, with the admission of one definite point the whole problem resolves itself into a very simple calculation, as is demonstrated by the examples given to illustrate the following method. A beginning is made on the statement that the utility can economically extend its line a fixed distance to serve any customer without a line charge. In strict truth, of course, this distance will not be the same for all customers, but it can be taken as fixed for any one class of customers.

Accepting, then, a fixed distance of free line extension for each customer the method may be stated as an extension rule in about the following words:

"The company will make extensions to its present line a distance of 100 ft. to serve any customer, the cost of such extension being estimated to average $20, and is called the 'free limit extension.' For customers requiring extensions greater than the free limit, such extensions will be made by the company and for every 100 ft. or major fraction thereof above the free limit extension the customer will have added to the monthly bill, estimated on the standard urban rate applying to the class of service to be furnished, an extension charge of 20 cents.

"If the extension is made to serve more than one customer, the extension charge will be prorated between the customers served on the basis of the number of 100 ft. sections of the extension or major fractions thereof between each customer and the point where the extension is to be attached to the company's present line after deducting a free limit extension from each customer. As customers are added or taken off the extension, the extension charge will be adjusted accordingly and prorated on the basis above described. As customers are added at an average of one for every 100 ft. of extension, the point at which the extension is considered to be attached to the company's present line will be moved accordingly."

The following examples, together with the various parts of the accompanying sketch, illustrate how the extension charge is to be applied. The present distribution line is indicated in the drawings by a dotted line and the extension by the solid line.

Example I.—Assume an extension of 500 ft. to serve the first customer, called A. There are five 100-ft. units of length, which unit of length has been taken as the average length of line per customer the company now has in its distribution system to serve its present customers, and the average cost is $20 per unit. The company agrees to bear the cost of one customer unit length for the new customer. This is called the free limit and is marked F1-A, free limit for Customer A. To avoid disturbing the present rate base and to enable the company to furnish service to A at the standard rate, Customer A should be charged an amount sufficient to pay interest and depreciation on the extra amount of money invested for him over that of the regular customer. For ease of keeping record and understanding, the extra charge should be shown as so much for each unit of extension and the total billed as an extension charge added to the regular rate charge. The extension charge of 80 cents in this case is made up of four charges of 20 cents each.

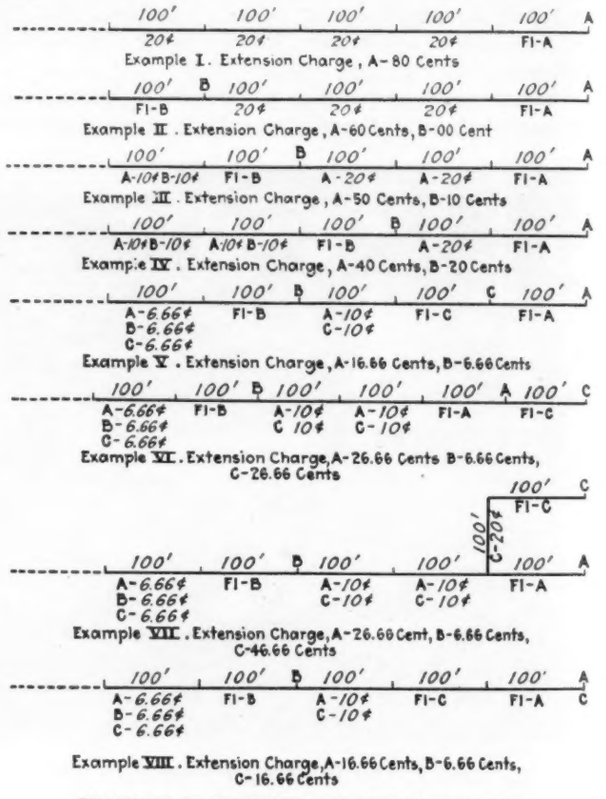
Example II.—Assume a second customer, B, is added, the free limit or first 100 ft. of the original extension becomes chargeable to B and the first customer's monthly extension charge will be reduced by one unit charge, or to 60 cents.

Example III.—If the second customer, B, is added in the second unit or 100-ft. section of the extension made to serve the first customer, the first customer's extension charge will be reduced to 50 cents and an extension charge of 10 cents added to the second customer's bill.

Example IV.—If the second customer is added in third unit or 100-ft. section of the extension made to serve the first customer, the first customer's extension charge will be 40 cents and an extension charge of 20 cents added to the second customer's bill.

Example V.—If a second customer is added in the second unit or 100-ft. section and a third customer, C, added in the fourth unit or 100-ft. section of the extension made to serve the first customer, the first customer's extension charge will be 16⅔ cents per month, the second customer's extension charge will be 6⅔ cents per month, and the third customer's extension charge will be 16⅔ cents per month.

Example VI.—If another extension unit of 100 ft. must be made beyond the original extension to serve the third customer, C, the extension charges for each will be A, 26⅔; B, 6⅔; C, 26⅔ cents.


100' 100' 100' 100' 100' A
20¢ 20¢ 20¢ F1-A
Example I. Extension Charge, A-80 Cents
100' B 100' 100' 100' 100' A
F1-B 20¢ 20¢ 20¢ F1-A
Example II. Extension Charge, A-60 Cents, B-00 Cent
100' 100' B 100' 100' 100' A
A-10¢ B-10¢ F1-B A-20¢ A-20¢ F1-A
Example III. Extension Charge, A-50 Cents, B-10 Cents
100' 100' 100' B 100' 100' A
A-10¢ B-10¢ A-10¢ B-10¢ F1-B A-20¢ F1-A
Example IV. Extension Charge, A-40 Cents, B-20 Cents
100' 100' B 100' 100' C 100' A
A-6.66¢ F1-B A-10¢ F1-C F1-A
B-6.66¢ C-10¢
C-6.66¢
Example V. Extension Charge, A-16.66 Cents, B-6.66 Cents
100' 100' B 100' 100' 100' A 100' C
A-6.66¢ F1-B A-10¢ A-10¢ F1-A F1-C
B-6.66¢ C 10¢ C-10¢
C-6.66¢
Example VI. Extension Charge, A-26.66 Cents B-6.66 Cents,
C-26.66 Cents
100' C
F1-C
100' C-20¢
100' 100' B 100' 100' 100' A
A-6.66¢ F1-B A-10¢ A-10¢ F1-A
B-6.66¢ C-10¢ C-10¢
C-6.66¢
Example VII. Extension Charge, A-26.66 Cent, B-6.66 Cents,
C-46.66 Cents
100' 100' B 100' 100' 100' A
A-6.66¢ F1-B A-10¢ F1-C F1-A C
B-6.66¢ C-10¢
C-6.66¢
Example VIII. Extension Charge, A-16.66 Cents, B-6.66 Cents,
C-16.66 Cents

EXAMPLES OF APPLICATION OF METHOD FOR LINE EXTENSION CHARGES

Example VII.—A lateral extension is made two units or 200 ft. in length to serve Customer C. The two additional units are chargeable to C only, and the other units of the original extension prorated between those it is to serve. The unit is divided equally among those customers it serves, allowance of a free limit unit having been made for each customer.

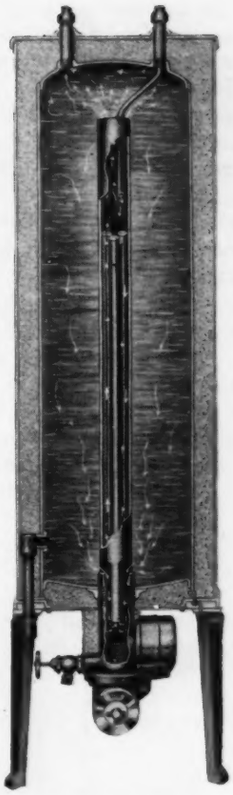
Example VIII.—Here the extension charges are made with A and C attached at the same point. The results are the same as found in Example V above. If five customers were attached to the extension at the point to which A is attached, the free limit allowance would eliminate all extension charges.

In a similar manner an extension of any length may be made for any number of customers and by use of the extension charge the burden of the extension is properly divided among all customers served. As new customers are added, the extension charge is easily readjusted. When there is an equivalent of one customer per unit of length for a part of the extension lying between some point on the extension and the point of connection of the extension to the main system, the extension charge is canceled for that part on which that average obtains.

Electric Water Heating

Experience on Pacific Coast

Extensive water-heating load leads utilities to study various systems and rates that obtain. Low-capacity flat or metered rate versus high-capacity metered service



CUTAWAY VIEW OF NEW TYPE WATER HEATER, SHOWING THE WATER-CIRCULATING SYSTEM EMPLOYED

WATER heating, as a domestic load, has reached such proportions on the Pacific Coast that central-station men are faced with the serious question of deciding which of several systems in use is the best to adopt for the future and what the rates shall be for water-heating service. Two general systems have come into use, brought about largely by the necessity of solving the water-heating problem when an electric range is installed and partly as a result of public demand for an electric water-heating system.

Small-Capacity Flat-Rate Type

Twelve years ago, when W. R. Putnam, L. A. Lewis, A. C. McMicken, H. J. Gille and others foresaw the possibilities of the electric range and began aggressively to push its sale, they recognized the necessity of finding some means of heating water electrically in order to get the wood or coal range out of the kitchen. Having no precedent to follow, they adopted the low-capacity, continuous-type heater and made a flat rate which, in their opinion, would economically permit heating water electrically. That water-heating business has developed under this system is evidenced by the fact that there are now more than 20,000 of these small-capacity heaters, some metered and some flat-rate, in operation on the lines of the Northwest utilities. Whether the choice of a low-capacity, continuously operating heater was a wise one remains to be seen, but it is felt by some that it may have been unwise to adopt flat rates, and especially such low rates, because the tendency in the central-station industry has been away from flat rates for any type of service and because when a flat rate is once established for a given service it is difficult to bring about a change.

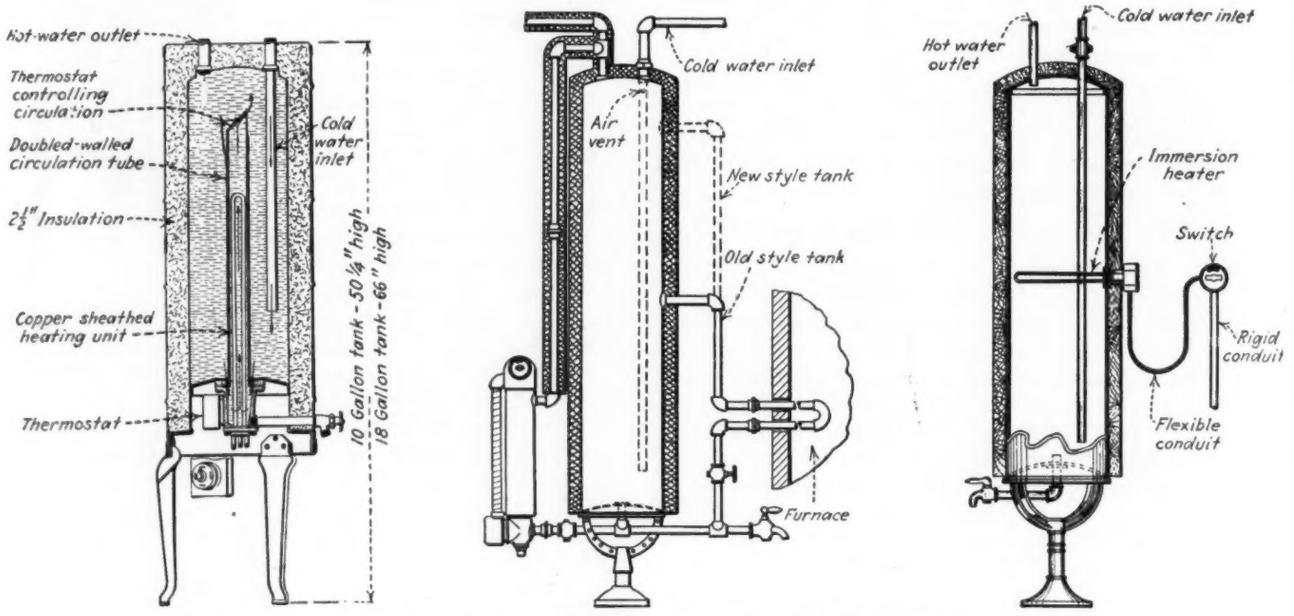
On account of the very low flat rates that were made for this service it was early felt desirable to require the water heater to be connected through a double-throw switch so that a part of the range, usually the oven, would be inoperative when the water heater was in operation. The purpose of this was to keep down the demand, and the system was required and still is required by several of the large utilities. Others, however, permit the heater to be operated 24 hours a day without regard to the range. Thermostats have been used on flat-rate heaters in some cases, although by far the greater proportion of the heaters are not thermostatically controlled. Invariably insulated tanks and piping are recommended to reduce heat losses, but since the customer feels that he does not have to pay for radiation losses, there has been a strong tendency on his part to omit the lagging if sufficient hot water was otherwise obtained from a given-sized heater. Heaters have been of the insert, circulation or clamp-on types, ranging in capacity from 600 to 1,500 watts. Rates and other data for this service in several Northwest cities are as follows: In Spokane, 600-watt, $2; 750-watt, $2.50 1,000-watt, $3, and 1,500-watt $4.50 per month. This is the so-called controlled flat rate with the water heater operated on a double-throw switch against the range oven. In Spokane there were 5,109 heaters on the lines of the Washington Power Company at the end of 1926, most of which are of the clamp-on type. The average size of the heater is is about 750 watts and the average monthly consumption is approximately 500 kw.-hr., or 6,000 kw.-hr. per year. On Dec. 31, 1926, the water-heater saturation in Spokane was 22½ per cent and the range saturation was 25 per cent. Practically 97 per cent of range users have water heaters also. Fifty per cent of domestic customers are considered prospects for water heaters. The cost of wiring for a water heater averages $10, and this expense is borne by the customer.

On the system of the Idaho Power Company, where a flat rate originally obtained, water heaters are now on a separate meter and energy is sold at a rate of 1 cent per kilowatt-hour. The predecessor companies of the Idaho Power Company adopted a flat rate, and one of the problems of the present management has been the abolishment of this rate and the substitution of a metered rate. When the flat rates for water heating were abolished by order of the Public Utilities Commission of Idaho on March 1, 1924, old customers were allowed to continue on a flat rate of 6 mills per kilowatt-hour for three years, or until March 1, 1927, all new customers being required to pay 1 cent per kilowatt-hour. Effective March 1, 1927, all customers are on the 1-cent rate. Throughout the year 1926 the company served 3,356 customers at the 6-mill rate and 692 customers at the 1-cent rate. The average consumption of the 6-mill customers was 5,496 kw.-hr. per year and that of the 1-cent customers was 3,240 kw.-hr. per year. This marked difference in consumption can be accounted for by the fact that the majority of the 6-mill customers have no protective covers to insulate their tanks, since they are in the habit of utilizing the tank as a radiator to heat

the bathroom or kitchen during the winter months, whereas the 1-cent heaters, generally speaking, are manually controlled and there is a tendency to conserve the higher-priced energy. The fact that both groups of customers are about equally well satisfied indicates clearly that what amounts to a low flat rate is conducive to extravagant use of energy and hot water.

There are now 4,990 water heaters on the system of the Idaho Power Company, most of which are of 1-kw. capacity and all of which operate independently of the range. The average annual consumption for all heaters is 5,086 kw.-hr. Water-heater saturation is 21.6 per cent and 73 per cent of range users have water heaters. Thirty per cent of domestic customers are considered prospects for electric hot-water heating. The average cost of wiring for a water heater in this territory is $9, and this expense is borne by the customer.

In Portland, heaters of the low-wattage type are used



THREE TYPES OF MODERN ELECTRIC WATER-HEATER CONSTRUCTION

At left, sectional view, showing construction details of a late type electric water heater.
In center, circulation-type electric water-heater installation as recommended by one large manufacturer.

At right, method of installing insert-type electric water heater. Another method than that shown at the right of installing insert heaters preferred by some is to place the heater in the bottom of the tank instead of the side.

110-volt meter is added to the expense of the company in serving flat-rate water heaters.

Conditions in Seattle are quite similar. The rate for water heating on the system of the Puget Sound Power & Light Company is $4 per kilowatt-month for year-round service and $5.50 per kilowatt-month where the customer wishes to reserve the right to disconnect the heater when hot water from other sources is available. Double-throw switches are not required, as it was found that this limitation on service resulted in loss of considerable water-heating business due to customer dissatisfaction.

The Utah Power & Light Company until recently had virtually no water-heating business. This company now has a number of 3-kw. heaters on its lines and is watching these closely to obtain data upon which to base its future water-heating policy. One of the important questions now confronting the executives of the company is whether or not to require a double-throw switch to reduce the demand when the range is in operation. They also expect to determine the diversity of 3-kw. heaters, with and without the double-throw switch.

and in about 95 per cent of the cases are operated on a double-throw switch in conjunction with the range oven. The rate is $3.50 per kilowatt-month when so operated. An unrestricted flat-rate service is offered also at a rate of $5 per kilowatt-month. The average size of heater and average consumption are about the same as in the two other cases cited. On the two central-station systems in Portland there are a total of 2,300 heaters, giving a saturation of 2.75 per cent. Most of the heaters now being sold are of the 1,000-watt circulation type and the installation of such a heater on a double-throw switch without lagged tank costs the customer around $45. A 1,000-watt heater costs $17.85, the special double-throw switch $13.25 and the wiring about $13. Insert or clamp-on type heaters are proportionally less.

The Portland Electric Power Company has found it necessary to place a check meter on all flat-rate water-heating service to make sure that the size of the heater is not changed without notifying the company and to prevent theft of current. Thus the cost of a 10-amp.,

Advantages and Disadvantages

There are some advantages to the low-wattage, continuous, flat-rate water-heating system and several disadvantages. The advantages may be said to be a base load with low demand (about 750 watts) and high load factor (about 70 per cent), comparatively low initial cost of heater (average about $17.50) and moderate wiring expense (average about $12.50). The disadvantages may be summed up briefly as follows: Objection to a flat rate of any kind from the standpoint of both the utility and the regulatory body; low return per kilowatt-hour (from 4½ to 7 mills) and low return per kilowatt-year (from $36 to $48); tendency to extravagance in the use of energy which is wasted in radiation losses; low rate of recuperation when hot water is exhausted on

wash days or when water for more than one or possibly two baths is required.

Although the low-wattage, flat-rate heater was an expedient to get range business, the case of this system has by no means been disproved. There is, however, a disposition on the part of some Northwest utilities to make a change, as evidenced by the change in Boise and a recent development in Portland and Seattle. In the latter two cities a system is being tried out that overcomes some of the objections and yet retains some of the advantages of the system. Here a number of installations have been made with a low-wattage insert or circulation-type heater on flat rate to provide for normal hot-water demands and a high-wattage or booster heater (3 to 3.5 kw.) of the circulation type on a meter to take care of the unusual demands for hot water. One manufacturer is now making a circulation type heater with three 1,000-watt elements, one of which is connected to a 110-volt flat-rate circuit and the two others to a 220-volt metered circuit.

The booster heater may be manually or thermostatically controlled, or both. When thermostatically controlled, in some cases it has been found desirable to place the thermostat near the top of the tank to avoid bringing a whole tank of cold water up to a high temperature with high-rate energy when there is no necessity for it and the low-wattage flat-rate heater would do it equally as well. The booster heater is generally required not more than an average of six hours a week, which adds 72 kw.-hr. to the customer's total consumption. To illustrate how this works out from the customer's standpoint, assume an installation of a 1,000-watt flat-rate heater with a 3-kw. booster heater. The customer pays $4 a month for the flat-rate service, and at an average rate of 2½ cents per kilowatt-hour he would pay $1.80 for metered service, making his total water-heating bill $5.80, for which he secures a much more satisfactory hot-water service and one that has flexibility to meet varying and abnormal demands for hot water. From the standpoint of the utility it is giving customer satisfaction, it is supplying a load with good over-all load factor and with high diversity for groups of booster heaters, and it increases water-heater revenue by 45 per cent.

Whether or not this is the ultimate solution to the water-heating problem for some utilities no one is willing to hazard an opinion, but it does possess considerable merit and has resulted in displacing a number of instantaneous gas heaters, at the same time giving better service at a much lower cost. In any event it will prove a valuable step in the transition from flat-rate to metered service in case this is later found to be desirable or necessary.

Large Capacity Intermittent

The other general system in use on the Pacific Coast is that adopted by the California companies. Here the heaters are of large capacity, ranging from 2.5 to 6 kw. on metered service, and are operated thermostatically or manually to meet the demands for hot water. Some companies follow the practice of requiring the heater to be connected through a double-throw switch so that a part of the range, usually the oven, cannot be operated when the heater is on. Others recommend thermostatic control, either with or without the double-throw switch feature. There are now 10,000 or more installations of high-wattage heaters in California, operating on average rates varying from 2 to 4 cents per kilowatt-hour.

A survey of metered water heating in California made two years ago by a committee of the Pacific Coast Electrical Association furnished some interesting data on the situation in that state. The report covered questionnaire returns from nine central stations serving practically all domestic customers of the state and showed 7,183 water heaters on the lines of the reporting companies. More than two-thirds of this number were of 4-kw. or 5-kw. size and about 85 per cent of range customers used water heaters. Of all the water heaters reported, 87 per cent were of the circulation type, 58 per cent were equipped with thermostats and 2,447 of these were supplying continuous hot-water service.

The monthly kilowatt-hour consumption where continuous automatic hot-water service was supplied ranged from 100 to 987 kw.-hr. and averaged 574 for all companies. Where water was heated intermittently only, the

MODERN RANGE AND WATER-HEATER INSTALLATION IN APARTMENT KITCHEN

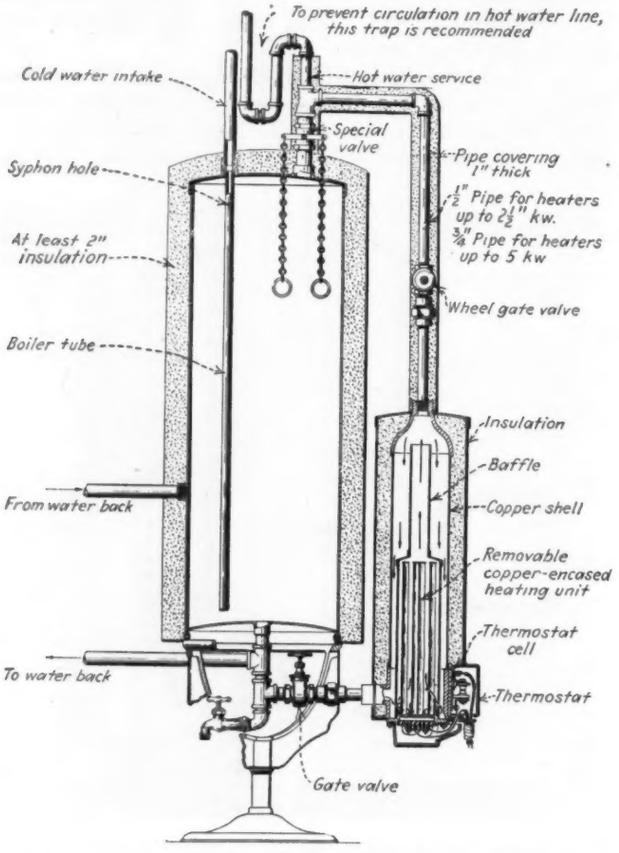
consumption ranged from 150 to 360 kw.-hr. and averaged 210 kw.-hr. for all companies. Nearly all of the water heaters reported were operated on a rate of 2 cents; therefore the automatic heaters were producing a revenue of $11.48 per month and the intermittent heaters $4.20 per month. The report showed further that practically all of the companies recommended heaters of from 1.5 to 3-kw. capacity without double-throw switch where continuous hot-water service is to be maintained and 4 or 5-kw. heaters for intermittent service. The double-throw switch was reported to be satisfactory where the heater capacity was relatively large, whether or not the water is kept hot continuously, but usually not satisfactory where heaters are smaller than 4 or 5 kw.

The report concluded with the following statements: "Electric water heating is a success on a meter rate of 2 cents per kilowatt-hour. On this rate about one-third of all water heaters reported are supplying continuous automatic hot-water service. However, the proportion of consumers maintaining continuous hot water with its desirable effect on load and revenue will naturally increase or decrease as the rate for such service increases or decreases.

"An average sized automatic water heater, say a 4-kw.

heater, on a 2-cent rate earns an annual revenue of $137.76, or $34.44 per kilowatt-year. A 3-kw. automatic water heater supplying the same service earns $45.92 per kilowatt-year."

This report contained much valuable information, but unfortunately it could not go into the very vital question of diversity, no data being available from the reporting companies. Only one company was willing even to make an estimate, and this company reported that it estimated



THREE-GALLON AUXILIARY TYPE AUTOMATIC ELECTRIC WATER HEATER CONNECTED TO A STANDARD TANK

the diversity to be 3 to 1. It is generally felt that water-heater diversity is lower than this figure and that the true diversity will lie somewhere between the estimate and the diversity of the electric range, which was shown to be about 10 to 1 by the Northwest range survey. At a diversity of 5 to 1 a group of 3.5-kw. heaters would have an average demand of 700 watts on the peak, and the diversity should be at least this good if the load characteristics of high-wattage heaters is to be as desirable as that of the low-wattage heater which has an average demand of about 700 watts on the peak.

In an effort to aid in the solution of some of the water-heating problems manufacturers have developed several systems that possess merit. One system that has proved successful, especially where the water-heating rate is relatively high (3 to 4 cents), makes use of a small auxiliary tank of about 3-gal. capacity, which is kept hot continuously by a thermostatically controlled 4.5-kw. heater. A two-way valve operated by pull chains permits the main tank to be cut into the circulation system so that larger quantities of water may be heated when occasion demands. The small tank is heavily insulated to keep radiation losses to a minimum, yet continuous hot-water service is available. The consumption of such a heater is only about 300 kw.-hr. per month, as compared with about 500 kw.-hr. for the same sized heater maintaining continuous hot water with a large tank only.

Data from Range Survey

The Northwest range survey showed that the average connected load of a group of 150 low-wattage, flat-rate heaters in Spokane was 814 watts and that the maximum demand per heater was 761 watts. This would indicate a diversity of 1.07 to 1. In Payette, Idaho, on the system of the Idaho Power Company, where the majority of water heaters are of the 1-kw. size, the range survey showed that the average connected load of 150 water heaters was 967 watts and that the maximum demand per heater was 750 watts, indicating a diversity of 1.29 to 1. It is interesting to note that the diversity of the heaters in Payette, where they are operated manually independent of the range as occasion for hot water demands, was greater than in Spokane, where the heaters are operated on double-throw switch against half of the range. This undoubtedly is indicative of a tendency for the diversity to go up as the size of the heater increases. It is interesting also to note that the consumption of the Spokane heaters was 112.5 kw.-hr. per week, as compared with 76 kw.-hr. per week for the Payette heaters.

The practice with respect to the use of a double-throw switch is by no means uniform, some companies requiring it and others being opposed to it. However, the consensus of opinion seems to favor some means of limiting the demand of the range and water-heater combination. This has naturally brought about a demand for an automatic load-limiting device, and two large range manufacturers have recently placed on the market devices that will automatically limit the combined range and water-heater load to any predetermined value. The fact that these devices are considered rather expensive ($15 to $20) and have not been extensively tried out in service may somewhat retard their early adoption. However, devices working on similar principles have proved successful on other appliances. They fill a definite need and many utility men have shown interest in them.

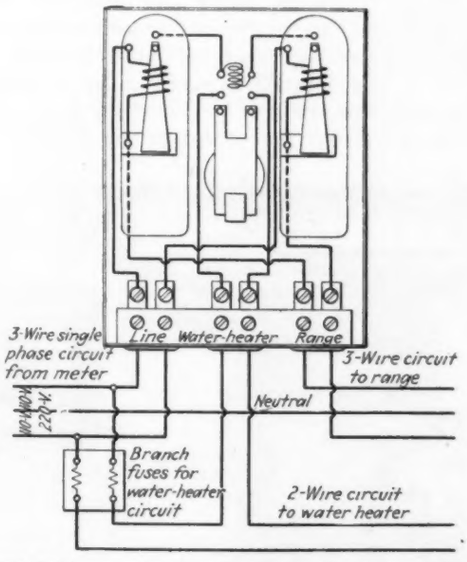
In the Northwest range survey a group of fifteen water heaters was tested both with and without double-throw switches, and it was found that the use of the double-throw switch reduced the amount of the water-heater demand on the range and lighting peak by approximately one-half. On a typical day it was found that the demand at 5:45 p.m. of fifteen heaters without double-throw switches was 5 kw. and the demand of the same size group of heaters with double-throw switches at the same time of day was 2.5 kw. The tests were made on a group of heaters having an average connected load of approximately 967 watts.

In order to determine the effect on kilowatt-hour consumption with and without a double-throw switch the Western States Gas & Electric Company made a check of a number of rural customers and found that those using water heaters without double-throw switches averaged about 125 kw.-hr. per month more than those with double-throw switches. The water heaters considered were thermostatically controlled and ranged in capacity from 3 to 5 kw. The commercial manager of this company feels that the additional consumption of water heaters not on double-throw switches justifies the greater demand of the water-heating load at the time of the range peak.

Water heaters of high wattage, such as those discussed, seem to be in greater favor on the Pacific Coast than

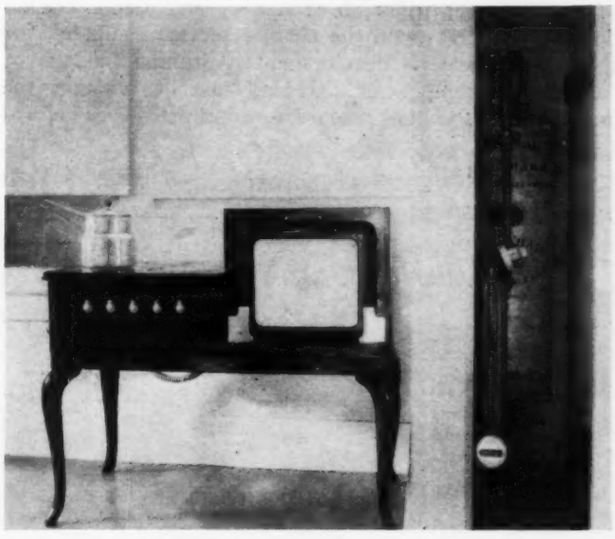
heaters of the low-wattage type, although, as already brought out, several companies have had success with the low-wattage continuous heaters and are by no means ready to discard the system. The principal objection to the low-wattage heater has been that it requires a low energy rate, on account of high radiation losses, to keep the customer's bill down to the point where water-heating service can be sold. Few power companies feel that they can sell energy at 110 watts to a residential customer at any such rates as 4.5 to 7 mills per kilowatt-hour, and even the one company that is receiving 1 cent per kilowatt-hour is not entirely satisfied with the rate. Thus the high-wattage heater, which may be used much as a manually or an automatically controlled gas heater, has come into favor because it lends itself to the application of a meter rate of approximately 2 cents. That water-heating service can be sold at such a rate is evidenced by the fact that there are more than 10,000 large-capacity water heaters on the lines of California central-station companies. It should be pointed out, however, that a large proportion of these heaters are in use outside of territories where cheap gas is available, hence it does not necessarily follow that any great amount of water-heating load can be built at an energy rate of 2 cents per kilowatt-hour in competition with low-priced gas. On the other hand, there are probably at least 3,000 flat-rate water heaters in use in the Northwest, where gas is available at around $1 per 1,000 cu.ft.

Notwithstanding the fact that the low-wattage heaters in the Northwest operate on low flat rates, it is interesting to find that they bring an annual revenue of from $36 to $48 per kilowatt-year, as compared with an average annual revenue of from $34.44 to $45.92 per kilowatt-year for the larger-capacity heaters in general use in California. A 3 or 4-kw. heater with an annual revenue of $34.44 or $45.92 per kilowatt-year respectively, however, yields the central station a total annual revenue per customer of $137.72. This simply means that revenue per kilowatt-year is not the whole story, but that diversity, demand, load factor and other characteristics of the load must be taken into consideration also.



WIRING DIAGRAM OF PEAK LIMITER USED TO LIMIT THE COMBINED DEMAND OF A RANGE AND WATER HEATER

It is axiomatic that any piece of business can be served profitably by the central station at some specified rate. Whether the cost to serve is such that a rate can be made that will get the business is another matter, and this is the crux of the water-heating question. The Northwest companies that really pioneered the water-heating business took the position in the beginning, and perhaps justifiably so, that they could afford to serve water heating at a slight loss in order to develop a profitable range load, but the tendency today is away from this viewpoint. This question of rates, however, cannot be answered until the characteristics of the water-heating load are made available by the comprehensive tests now under way in California and until there is more knowledge available by individual companies as to their allocated system costs.



WATER HEATERS PLACED IN CLOSET CONTAINING THE TANK. AN INSULATED TANK IS TO BE PREFERRED

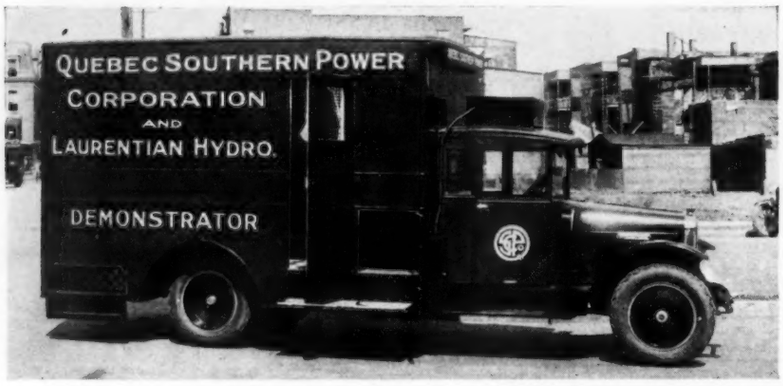
Nevertheless it is interesting to consider the water-heating business from the standpoint of increased consumption per domestic customer. The average annual lighting consumption of residence customers varies from 200 to 250 kw.-hr. per year. Normal use of appliances increases the average consumption possibly 150 kw.-hr. per year. The electric refrigerator uses on an average of about 500 kw.-hr., but since it does not seem probable that one-third of the residence customers, at least for many years to come, will use electric refrigerators, the average consumption of all homes can be estimated to increase approximately 150 kw.-hr. per year after electric refrigerators have been well placed.

Electric ranges have been found to use approximately 1,500 kw.-hr. per year. Assuming that one-third of the customers will cook electrically, the average consumption of all customers will increase 500 kw.-hr. per year on this account. If it is safe to assume that water heaters will use at least 3,600 kw.-hr. per year and that one-third of residential customers will heat water electrically, the average consumption of all customers for this purpose will be 1,200 kw.-hr. per year. The probable average annual consumption of residential customers that can be reasonably expected then would be: Lighting, 250 kw.-hr.; appliances, 150; refrigerators, 150; ranges, 500; water heaters, 1,200 kw.-hr. This is approximately six times the present average consumption of all residential customers in the United States and does not take into consideration possible increases from air heaters and other special appliances.

Demonstration Car Aids Rural Sales

By W. Evans
Industrial Department Quebec Southern Power Corporation

THE enterprising dealer with an attractive show window and subsequent practical demonstration of appliances is the one who makes the sale. In the case of rural districts this job of display and demonstration devolves entirely upon the electric service company, for the district dealer's development is stunted by lack of capital and competition. Usually he has neither the imagination nor the resources wherewith to perform these essential functions. For this purpose we decided to use a combined demonstrator-sales-service car. The results have been extremely gratifying, and this machine, which combines the functions of advertising, displaying, demonstrating, selling and servicing electrical appliances, seems to promise the solution of an extremely difficult problem at present confronting our company in the rural districts.



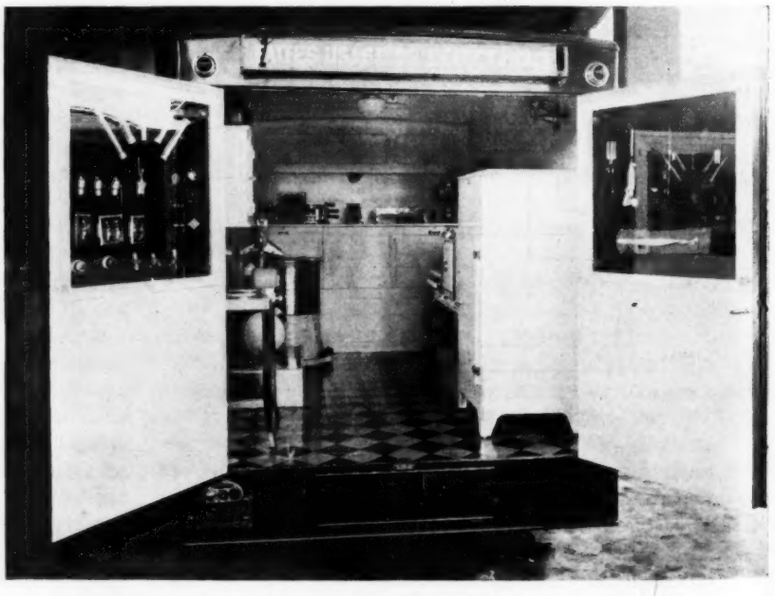
APPLIANCE SALES, DEMONSTRATOR AND SERVICE CAR FOR RURAL SECTIONS

A speed truck of 1½ tons to 2 tons capacity is used. Show windows for displaying small apparatus are fitted in the two large rear doors. The interior of the truck has the appearance of a perfectly fitted-up kitchen. There is a counter at the front of the compartment running the width of the body which serves for the display of the smaller appliances, these being fastened securely to it. A complete stock of lamps and smaller appliances is kept in the roomy cupboard above the counter, as well as a supply of pamphlets and other advertising matter for distribution.

The car is so wired and equipped that by hooking up to the 110-volt distribution line or any other 110-volt source of supply it is possible to operate any of the appliances which it carries exactly as they would operate if installed in a house. All the wiring is concealed in the walls, and numerous convenience outlets are provided near the baseboard and on the counter. To supply current for the lighting of the interior of the car and the front and rear advertising signs, when it is inconvenient to use the 110-volt distribution service or when the car is in motion, a 32-volt storage-battery service with motor-generator set for charging is installed in one of the compartments. One hundred feet of extra-flexible two-wire cable is carried in a box on top of the cab. Special hooks for attaching this cable to the 110-volt service are provided. The other end is connected to a length of flexible conduit and a 50-amp. fuse service box at the front of the body beside the cab.

The car contains a refrigerator, range, washing machine, automatic water system, water heater, two-plate range, ironing machine, fan, double hot plates, radiant room heater, electric irons, toasters, percolator and grill. Smaller appliances include immersion heaters, soldering irons and a radio set with loud speaker and chargers. The radio set has been installed not only because it is a load builder, but because it is operated while the car is stationed for a demonstration and thus attracts an audience for the demonstrator. The range is wired directly to the service box through a large plug in the floor of the car. This permits the make and type of range to be easily and quickly changed from time to time. The other appliances, being simply plugged into the nearest convenience outlet, can also be frequently interchanged with others in order to maintain the public interest by a diversity of display. The automatic water-pumping outfit is arranged with a system of pipes and valves permanently installed in the car, the inlet and discharge pipes running to two hose connections on the outside.

A small library of specially prepared sales books contains photographs, price lists, etc., of all kinds of domestic electrical appliances carried. It is the duty of the car attendant to be thoroughly familiar with the contents of these sales books and to be able to supply all information pertaining to and quote promptly the price of any particular article concerning which he may receive an inquiry. Unanswered inquiries must be noted in a daily log book and reported by the driver to his superior. Small repair jobs are performed by the driver.



ELECTRICAL APPLIANCES ARE DEMONSTRATED AT THE CUSTOMER'S DOOR BY TRAVELING SHOWROOM

Small Manufacturer's Market

Develop a specialty, know when not to take an order, gain recognition in the field and adhere to the policy set as necessary for building a sound business

By a Small Electrical Manufacturer

IT IS just as important for the executive of the small electrical manufacturing plant to decide when not to go after certain available business as it is to know when to accept business. It is not a wise course to go into the thick of the field and fight for business that must be served by large production and correspondingly lowered cost. There is plenty of opportunity in the electrical industry for specialized applications, and as the industry grows there will be even a greater opportunity for the specialized service of the small electrical manufacturer.

Each small manufacturer must ask himself what he can do to justify economically his existence, for without a definite economic justification the business is not founded on sound principles. The small manufacturer cannot hope to make much progress by competing in a field that can be and is being served by volume production. He should seek to develop his business by offering to the trade a specialty that can be manufactured in reasonable quantities and thus develop along that line. After having worked out such a policy, proper recognition of the product should be sought in the field being served. No manufacturer can with common sense pursue a policy other than that of satisfied customer relationship. The specialty manufacturer has far more opportunities for building up a sound clientele and nearly always, because of his specialized experience, can offer a sounder guarantee to his customers.

Value of Not Accepting Every Piece of Business

To illustrate how this works out and to show the value of not accepting every piece of business, even though it is offered to the manufacturer, an actual case can be cited. A manufacturer of specialty equipment was called upon to furnish three special units of a type of special machine on which the manufacturer had concentrated his efforts. The buyer was also in the market for 48 standard 7½-hp., three-phase, 60-cycle motors, and he offered this business to the electrical manufacturer in addition to the order for the three special units. However, the manufacturer did not immediately grasp this order, but explained to the buyer that although he made such motors to meet special conditions and could build the 48 motors for him, he preferred to utilize his factory space for the manufacture of his specialized equipment and would, if the buyer desired, furnish him with the 48 motors made by any manufacturer who was set up to produce such motors in volume. It is certain that the manufacturer did not lose the respect and confidence of the buyer, but on the contrary developed a better regard for his specialized product which he was organized to make efficiently.

In another case a buyer wanted a special generator which the manufacturer could supply. Ordinarily this electrical manufacturer would purchase a standard motor from a large maker and use that motor for driving the generator. However, the buyer made a special request for a synchronous motor drive to operate equally well on 50-cycle or 60-cycle current and further requested delivery in three weeks. It was utterly impossible to get such a motor from a large producer in less than six to nine weeks and in addition the price set by the large producer for such a motor would seldom be less than that at which the specialty manufacturer could build such a motor at a profit. The specialty manufacturer could nearly always meet the requested delivery. In this case that was done. The specialty manufacturer built the special synchronous motor and made the required delivery, gaining a satisfied customer at a competitive figure and—what should not be neglected as an item of importance—carrying out a profitable transaction.

Field of Operation Definitely Fixed

The specialty manufacturer should definitely fix his field of operations and should not be stampeded into accepting any business offered or in sight. A machinery dealer who had been in the habit of buying certain special apparatus from a specialty manufacturer made a request for a quotation on a standard motor. The specialty manufacturer in reply referred the machinery dealer to a manufacturer of such standard apparatus in large volume as being best able to serve his needs. His reply was as follows:

> Answering your inquiry regarding a 75-hp., 60-cycle, 220-volt synchronous motor, we do not believe it is the proper thing for us to quote, as you will be serving the best interests of all concerned by referring your customer to the —— Company.
>
> It is true that we manufacture synchronous motors, but it is equally true that in each and every instance we know exactly the work that synchronous motor will have to perform and we would not undertake to supply a synchronous motor unless we knew everything which good engineering as well as commercial responsibility and reliability requires.
>
> You can be sure that an engineer and not an ordinary salesman will be sent by the company named on a case of that kind. Your customer's problem may be extremely simple and his requirements may be met by any kind of synchronous motor, but until someone competent has looked into his case, no one can afford to take the chance of furnishing him the wrong kind of apparatus.
>
> Your customer will be thankful to you if you refer him to a competent and reliable organization, for by so doing you will make two friends, and the value of two friends is hard to figure in dollars and cents.
>
> We certainly appreciate your inquiry and regret that we cannot consistently be of service to you and your customer in this instance, but it is superfluous to assure you that when we can, we will be delighted to do so.

This article does not cover the entire field of the small electrical manufacturer, but describes the broad field of the small manufacturer in building specialty apparatus. Another but lesser field exists for the small electrical manufacturer in certain types of apparatus requiring volume production and in which the small electrical manufacturer can give a specialized service.—Editor.

If the small manufacturer is to build up a sound business, he must follow such a policy and concentrate his energies on the manufacture of a specialty that can be made in reasonable quantity. It is only in this way that he can economically justify his existence, for without some justification the business is not on a fundamentally sound basis.

Letters from Our Readers

Dielectric Puncture Under Oil

To the Editor of the ELECTRICAL WORLD:

The tests of dielectric puncture described by J. T. Littleton and W. W. Shaver in the ELECTRICAL WORLD for Sept. 10 (page 503) refer to full oil immersion in which the electrodes are surrounded with oil limiting the area of feed into the dielectric sharply to the contact area between the electrode and the dielectric. This artificial concentration of dielectric flux on an insulator for use in air causes an unfair attack which cannot be present in service owing to diffusion of charging current from the terminals through conductive corona.

In places where the electrode does not actually touch the dielectric sparks will rupture through the oil and attack the dielectric in such sharply concentrated points that digestion and spalling of the dielectric occur, as evidenced by rumbling and crackling a long time before puncture. This has been the difficulty with a puncture test of insulators under oil. It causes trouble in transformer bushings at the oil level in certain cases due to concentrated flux. The dielectric constant for oil is less than 2.5, while for porcelain it is nearly 6. The dielectric strength of oil is high. The oil resists puncture, and when puncture finally breaks it down the current is limited to a very concentrated path, the end of which presents a point attack on the dielectric.

Our notion of the mechanics of puncture in this case is that local heating produces expansion around the "bright spot" noted in the article. Expansion causes a mechanical tension in the adjacent region accompanied by a check or small crack that shoots off in a direction determined by the combined effect of the hot path already formed, by the direction of tension stress in the material and in general toward the opposite electrode. It is quite likely that two prongs or corners of such a crack may become the new focal points for two branching paths feeding farther into the dielectric body.

I quote the last paragraph of the article: "The fact that a partial puncture can be formed should make insulator manufacturers extremely careful in applying a routine overpotential test *under oil* if impairment of their product is to be avoided." I have underscored "under oil" as we do not test under oil in the Lapp "overpotential test" on suspension insulators. We have a diffused application of charging current not only through the air on the top of the shell but also underneath as a bubble of air covers the shell surface at the center and between petticoats. No damage in the nature of a partial puncture is done by our "overpotential test." This is shown by the fact that there is a definite clean-up of punctured units during the early part of the test, after which the test may be repeated or continued for a long period without increasing failures.

The trouble the authors have experienced is not unknown as one can hear and time the progress of the puncture path under oil. Actual observation of the progress of the rupture in glass is a very interesting phenomenon for which the authors deserve credit. It confirms the impression that one visualizes when he hears a puncture under oil proceeding. We do not know what sample of porcelain may have been tested. Our experience has been that a spalling or grooving action takes place at the surface of porcelain before allowing deeper penetration to develop a puncture. The grain structure and rough fracture of porcelain may help to prevent a tendency to crack readily ahead of the path.

A liquid having a very high dielectric constant is desirable for use in immersed puncture tests. In some cases extension barriers may be applied to insulators to permit puncture voltages to be applied without the inherent difficulty of the immersed oil test.

G. W. LAPP,
Chief Engineer.
Lapp Insulator Company, Inc.,
Le Roy, N. Y.

Two Figures that Need Alteration

To the Editor of the ELECTRICAL WORLD:

In my article on "The Importance of Post Spacing in Street Lighting," in the Sept. 24 issue of the ELECTRICAL WORLD, there was a slight mistake on page 609 in the lower right-hand corner of the chart showing the lighting curve. In curve 3 "six 10,000-lumen, two-light posts per block" should read "six 6,000-lumen." However, the text throughout carries the correct figures, and it should be evident to any one who wishes to make a study of the curves that the size of the lamp used was 6,000 lumens.

F. H. MURPHY,
Illuminating Engineer.
Portland Electric Power Company,
Portland, Ore.

To the Editor of the ELECTRICAL WORLD:

In my article entitled "The High Cost of Shadows,' which appears in the Oct. 15 edition of the ELECTRICAL WORLD, an error occurs on line 16 in the first column on page 794, where the term "5 foot-candles" should read "0.5 foot-candle."

ARTHUR A. BRAINERD.
Philadelphia Electric Company,
Philadelphia, Pa.

Recalls Offer of $1,000,000 for Telephone Development

To the Editor of the ELECTRICAL WORLD:

The notice in the Sept. 17 issue of the ELECTRICAL WORLD concerning the death of Charles J. Glidden, at one time the very energetic president of the Erie Telephone System, recalls to mind an offer of a million dollars he made in an article on the "Growth of Telephony," on page 868 of the ELECTRICAL WORLD AND ENGINEER for June 24, 1899, for either a successful telephone repeater or a quadruplex system. I wonder how many of your readers can recall this, too?

Mr. Glidden's alternative devices have both been realized in a far more effective manner than he would have anticipated. His offer stimulated experimenting, and many articles on telephone repeaters followed in your publication. It is too bad that Dr. DeForest was not a bit earlier in his work, as the prize would surely have been his.

MENRY MULFORD.
Patchogue Electric Light Company,
Patchogue, N. Y.

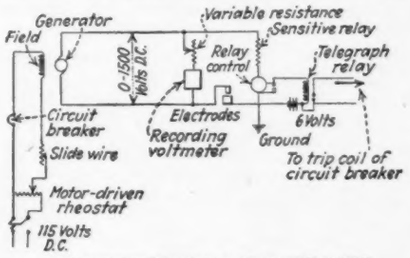
Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Service Conditions of Refractories in a Furnace Burning Pittsburgh Coal on Underfeed Stokers.—R. A. SHERMAN and W. E. RICE.—In this investigation the range of the service conditions of refractories—that is, refractory temperatures, furnace-gas temperatures, composition and velocity, and the amount and composition of the solid material carried in the gases when burning coal from the Pittsburgh No. 8 bed on underfeed stokers—have been determined and recorded. The temperature and reducing-gas content of the furnace gases were higher with the high-sulphur than with the low-sulphur coal. The sulphur content of the furnace gases was in approximately the same ratio as the sulphur content of the coals, and about one-half of the sulphur of the coal was in the gas at the points of sampling. The slag deposited on the walls by the low-sulphur coal was a heterogeneous, partly fused, thick coating which built up on refractories; that deposited by the high-sulphur coal was mostly fused, more homogeneous and thin, and eroded the refractories. The furnace-gas temperatures were higher in the chain-grate-stoker furnace than in the underfeed-stoker furnace burning the same type of coal, while the content of reducing gases was greater over the underfeed stoker. The furnace-gas velocities were more uniform and their average was greater in the chain-grate-stoker furnace. The amount of slag carried in the furnace gases was considerably greater, and refractories were eroded at a more rapid rate in the chain-grate-stoker furnace.—*Mechanical Engineering,* October, 1927.

Units, Measurements and Instruments

A Precision Measurement of Puncture Voltage.—V. BUSH and P. H. MOON.—The automatic determination of the dielectric strength of thin sheet insulation has been accomplished by the use of a recently developed apparatus. The machine makes about one thousand breakdown tests in a day. Practically no attention is required, and the human element is thus reduced to a minimum. The authors indicate the results of more than a hundred thousand punctures. An investigation of the effect of temperature indicates that none of these punctures occurred according to the thermal theories of breakdown. Tests to determine the effect of electrode area are also described. It is shown that statistical theory can be applied to the results with some success. The standard deviation of the breakdown values is a measure of the inherent variability of the material, and thus gives promise of value in the specification of installation. Copper and brass electrodes are commonly used for puncture tests. The present investigation indicates, however, that with such electrodes there is a "seasoning" effect, which produces a marked change in puncture voltage unless the electrodes are cleaned after each puncture or are allowed to reach a steady state before readings are taken. In the accompanying figure the relay control trips the breaker in the field circuit of the generator when a puncture occurs, owing to the rush of current through the relay. The recording voltmeter draws a line across the chart every time that the voltage rises. The pointer continues to move slowly across the chart until a breakdown occurs, whereupon it falls back to zero because of the opening of the circuit breaker. The length of the line is thus a measure of the breakdown voltage. Previous to the reraising of the voltage by the motor-driven rheostat the contactors on its rotor close and operate the



SIMPLIFIED DIAGRAM OF AUTOMATIC INSULATION TESTER

feed mechanism. This pulls a fresh piece of insulation under the electrodes. At the same time the circuit breaker closing coil is energized. The voltage is then built up as before. The cycle is as follows: Voltage is raised slowly; puncture occurs, tripping circuit breaker; feed mechanism operates; circuit breaker closes; voltage starts rising again.—*Journal of American Institute of Electrical Engineers,* October, 1927.

Impulse Testing Set.—H. MEHLHORN.—A set for commercial routine testing of high-voltage insulators is described by the author. The equipment gives a peak voltage of 500,000 to ground and has a capacity of 0.00125 mfd. Small over-all size is obtained through the use of a patented method of multiplying the original transformer voltage eightfold. The equipment consists of two kenotron rectifier tubes, eight condensers, eight ohmic resistors and five sphere gaps, all of which are mounted in four tiers highly insulated from each other and from ground. A 60-kv. testing transformer supplies the primary power. With certain changes in the connections the same equipment can be used for the generation of damped high-frequency oscillations.—*Siemens Zeitschrift,* August, 1927.

Illumination

Photo-Electric Cell Photometer.—CHARLES DESHLER and HENRY SCHROEDER.—A method of photometry which substitutes an electrical eye for the human eye has been developed by Mr. Deshler. The visual comparison of light forces, the photometer spot and the working-standard lamp have been entirely eliminated. The lamp whose lumens are to be measured is placed as usual in the sphere of an ordinary commercial spherical photometer. The integrated light of the lamp passes through a suitable test plate and filter, falls on the light-sensitive film which covers the interior surface of a photo-electric cell and causes the film to emit electrons. A suitable potential is placed across the cell, and the resultant electron emission or current is measured by a galvanometer. When the cell is so constructed that the electron emission is proportional to the light, the aforesaid meters become "lumen meters." The first essential, therefore, of a direct-reading method, as compared with null and substitutional methods, is exact proportionately. The wave-length sensitivities of photo-electric cells differ from one another and from the average human eye. Without a filter, therefore, the proportionality between the cell current and the light can only be maintained at the same wave length. With the proper filter the proportionality can be maintained through a large range of wave lengths. This particular photo-electric cell photometer is simple, inexpensive, quick and accurate. It is a single-operator daylight-operated apparatus, which eliminates the dark photometer room, the personal error in "spot matching," the photometer spot or cubes and the working-standard lamp, with all of its structural, mechanical and electrical requirements.—*Transactions Illuminating Engineering Society,* 1927.

Transmission, Substations and Distribution

Supertension Cables.—PERCY DUNSHEATH.—The reasons for the increasing tendency toward the raising of cable voltages are outlined and the essential features of cables which are to operate under these high potentials are reviewed. The designers of this type of conducting equipment are faced with the problem of producing material which can compete and operate with overhead high-tension lines. The limited heat-dissipating facilities of the cable in the ground offer a factor of increasing importance. The limit of use of a large number of low-voltage cables in such conditions, because of heating effects, is readily reached, and the only possible way of forcing the bulk power through the congested chan-

nel near the station is to reduce the currents by raising the voltage. Economies of construction and operation offer the prime consideration in this work. Methods of minimizing sheath losses by various means are given. Cables for 132,000-volt systems have been adopted as standard for extensive long-distance interconnection in Great Britain, so that the decision of the electricity commissioners in this matter renders more important the question of underground cables for this voltage. A cable may have a remarkably low, flat power-factor curve and at the same time possess a low breakdown strength —a fact which seems to be, in the opinion of the author, somewhat unappreciated by present-day engineers. A life test consisting of the following sequential operations is suggested: A mild bending test; measurement of power factor at room temperature over a voltage range; heating by current at full load, followed by cooling several times; repetition of power-factor test, and subjection of samples to breakdown test at various times up to 50 hours. The customary potential test of the completed drum lengths of cable has been viewed with suspicion by some engineers as being harmful to the cable. They feel that under certain conditions drum lengths may be sent out of the factory weakened almost to the point of failure by this test. Considerations of the time-voltage characteristic show that this fear is justified only if the potential test is carried out at too high a voltage. If the value is kept well below the ultimate breakdown strength no harm should be done, as it has been found practicable to make a cable with an ultimate breakdown value which is three times the working pressure. The usual factory pressure test, carried out on all cable delivered at twice working voltage, appears to be entirely justified.—*Electrician (England)*, Sept. 9, 1927.

Motors and Control

Thermionic-Valve-Type Close-Voltage Regulator.— F. C. TURNER.— A method of automatically maintaining the voltage of a generator within close limits over long periods is described by the author. A generator used for supplying electric furnaces was designed for a full-load output of 15 kw. at from 60 to 300 volts and normally was used at 210 volts. The problem involved was to adjust automatically the furnace voltage independently of the load on the machine, in order to maintain a steady temperature at the specimen. This was first done by using an air thermometer in the furnace and by utilizing the corresponding change of curvature of a mercury meniscus to make and break relay circuits. The air was inclosed in a glass or silica vessel, but such a bulb was inadmissible in creep tests on account of cost and probability of breakage when fracture of the specimen occurred. The author endeavored to adapt the method of using a spirally wound metal tube for the air bulb but abandoned the idea partly owing to the comparatively large expansion of the metal tube. The generator being shunt-wound and having a large operating range was very unsteady, and a small change in load caused a large voltage variation. The only solution was an automatic voltage regulator on the generator. In view of the cost of the available regulators and the small permissible change in voltage, an attempt was made to devise a regulator to permit a variation of not more than one volt in 200 at a reasonable first cost and a low running cost. The mechanism was required to take virtually no current and at the same time give a magnified effect. The thermionic valve meets the conditions and gives an indirect regulator. The various wiring diagrams and data regarding the specifications of material that are used are given by the author of the article.—*Electrical Review (England)*, Sept. 30, 1927.

Electrophysics, Electrochemistry and Batteries

Electrolytic Preparation of Para-Aminophenol.—DAVID CAESER.—A comparison of the electrolytic with the chemical processes for the production of para-aminophenol indicates several advantages which might accrue to the electrolytic process as a commercial method. The author investigated the choice of proper electrodes and current density for the electrolytic cell. Copper gauze as the cathode, duriron as the anode and a current density of 4 amp. to 5 amp. per square decimeter gave the best yields. Other factors influencing the electrolysis are the nature of diaphragm, composition of catholyte and anolyte, temperature of reduction and the catalysts employed. The author feels that the electrolytic reduction of nitro-benzene to para-aminophenol has bright commercial prospects. The 40 per cent material yield already obtained with the copper-gauze duriron combination, at a current density of 4 amp. per square decimeter, would probably be increased by further investigation of the factors previously mentioned as essential. It is possible, the author thinks, that a method might be found whereby productive oxidation will be carried out at the anode simultaneously with the reduction of nitro-benzene at the cathode by a process similar to that of previous investigators. Great savings in power would result, and the possibility of producing para-aminophenol on a commercial scale would be greatly enhanced by such a scheme. —*American Electrochemical Society*, September, 1927.

Studies on Sparking in Air.—A. PEN-TUNG SAH.— Sparking voltages and gradients in air between spheres of unequal diameter and between two cylinders placed with their axes perpendicular to each other in space, and known as cross-cylinders, have been determined. Complete tables giving the co-efficients of gradient corresponding to any given spacing and radii have been tabulated according to the formulas of Kirchhoff and Russell. For cross-cylinders an approximate formula has been developed. A more definite form of the theory of ionization by collision has been extended in the theoretical discussion to the sphere gap, and a relation has been deduced to account for the variation of the sparking gradient as investigated in the first part of this work.— *Journal of the American Institute of Electrical Engineers*, October, 1927.

Traction

Operating Experiences on Austrian Electric Railways.—H. LUITHLEN.—A detailed statistical account of the various troubles, faults and service interruptions on the generating, transmitting and rolling equipment of the extended Austrian federal railway system in past years. The chief power supply comes from two hydro stations, one for the permanent load and the other for peak loads. Regulators on the turbines and on the generators are set to accommodate this feature. Transformer and oil-switch troubles and overheating of coils on the generators were overcome by replacement with more suitable designs. In the substations the selective relay protection did not come up to expectations and the forced oil circulation on transformers failed repeatedly. The old type of horn gap and solid resistor overvoltage protection had to be replaced with more modern apparatus. Much difficulties are experienced with excessive rusting of overhead hardware in the 6-mile Arlberg tunnel. Neither spray-zinc-coated steel nor bronze proved satisfactory, but pressed-brass parts have given good results.—*Elektrotechnische Zeitschrift*, Aug. 25, 1927.

Gasoline-Electric Locomotive.— A. PASSAUER.—A German concern has recently furnished ten 500-hp. electric locomotives for a Southwest African diamond mine. Over part of the trackage the machine can be fed from an overhead 500-volt direct-current trolley wire, while a gasoline-driven generator has to supply reduced power over the remainder of the track. Sandstorms compelled the designer to choose internal worm-wheel transmission from motor to driving axles. A final provoking feature was the fact that the sandstorms reach at times a temperature of 158 deg. F. Four direct-current motors of 186 hp. output are closely mounted between the wheels of the twin truck chassis. In the middle of the locomotive is mounted a 200-hp., six-cylinder, 500-r.p.m. gasoline motor, directly connected to a 120-kw., 500-volt direct-current generator, which supplies enough power to pull the engine at one-quarter speed, or 2 miles per hour. The gas engine starts with compressed air, stored in a reservoir from a direct-connected air compressor.— *Siemens Zeitschrift*, August, 1927.

News of the Industry

Insull on Central-Station Economics

President of Commonwealth Edison Maintains that Low-Cost Steam Generation Is the Basic Factor in Modern Electrical Progress

"INTERCONNECTION, superpower, group management and all the rest of it have followed low-cost steam generation and distance transmission as naturally as day follows dawn. Neither financial hocus-pocus nor malign ambition for control—for 'getting a strangle hold on the public,' as it is sometimes phrased—has ever been a factor in this development. It has come in a logical succession of economic steps—often hesitant and faltering steps."

This defense of "the central-station industry of electric power" was uttered by Samuel Insull, president of the Commonwealth Edison Company, at the annual dinner of the Electric Association of Chicago on Thursday, Nov. 17. The subject matter of his remarks was frankly put forth as a recognition of recent questionings concerning the desirability of large aggregations of electric power, and a review of the economic fundamentals which have brought about these aggregations was the major content of the address. Mr. Insull said that the present electrical development of the country had its beginning primarily in the introduction of the steam turbine about 25 years ago. With all due credit to advances in the electrical arts, such as transmission and so forth, he maintained, reductions of generating costs have been the principal technical factor in this development. Economies in generation have provided a margin which has enabled the other factors of electricity—transmission and distribution—to grow so wonderfully.

Instancing in a very small way the tremendous growth of electricity supply systems in order to show the identity of determining factors and results in all cases, Mr. Insull described an experiment which was made by his associates and himself in 1910. This was to take a number of towns and villages in Lake County, Ill., and tie them into a unified system. Although this action required the shutting down of a number of isolated plants and also a much higher investment per kilowatt-hour of capacity, yet the operating economies and the greatly increased volume of business obtained resulted in lower selling prices for energy and greatly bettered conditions of service. The same economic considerations that determined that comparatively small undertaking operate in larger degree in the mightiest aggregations now existent.

Mr. Insull closed with a reminder to those associated with branches of the electrical industry other than central stations that the continued prosperity of the central stations is essential to the wellbeing of those branches as well. Difficulties arising between the central stations and other branches, if any do arise, should, he observed, be adjusted in a spirit of amity and fair dealing.

Holland Tube Opened

Vehicular Tunnel Between New York and Jersey City Goes Into Service—Electrical Features of Thoroughfare Under River Are Conspicuous

WITH the touching of a button at Washington by President Coolidge at 5 p.m. Saturday, Nov. 12, flags that obscured the New York City and Jersey City entrances of the Holland Vehicular Tunnel under the Hudson River were drawn aside and the public was admitted to the submarine passage on foot. At midnight it was thrown open to vehicles. Earlier in the afternoon official motoring parties had made the transit, and ceremonies, which included speeches by the respective governors of the two states and other prominent men, were made.

This 9,250-ft., forty-eight-million dollar tunnel, which has been under construction for seven years and agitation for the construction of which began twenty years ago, contains many electrical features. Its safety and success depend principally on two factors—ventilation and continuous lighting—and it is therefore of the utmost importance that the power supply be beyond the possibility of interruption. To insure this being the case power is received through three circuits on each side of the river at approximately 13,800 volts, three-phase, 60 cycles. On the New York side energy is supplied by the United Electric Light & Power Company and on the west bank by the Public Service Corporation of New Jersey. At least two independent circuits are available on each side, and switching arrangements make it possible to connect any portion or all of the tunnel load to any one of the six incoming circuits. All switching is done through General Electric truck-type switch panels.

The 42 blowing fans and 42 exhaust fans of the tunnel are driven by Westinghouse blower motors totaling, including spares, more than 6,000 hp. Approximately 250 kw. is required for lighting the tunnel and 150 kw. for lighting the approaches. This amount of power necessitates an extensive substation and distribution system. At each of the land ventilating buildings the 13,200-volt power is transformed to 2,200 and 440 volts by three-winding air-blast transformers. Six 2,200-volt cables, three from each end, run from one land ventilation building to the other, feeding at each ventilation building double 2,200-volt buses. The 440-volt energy is used locally in each land building and is not transmitted to any other building. At each river ventilating building the auxiliary power is at 220 volts supplied from the 2,200-volt buses through a transformer.

To facilitate the operation of the blowers, the fresh air and exhaust ducts below the floor and above the ceiling are divided into eight sections. With two exceptions each of these sections is supplied with fresh air by three blowers and the air is exhausted from each section by three exhaust fans. The exceptions are that sections 2 and 3 in the south tunnel and sections 6 and 7 in the north tunnel are combined into one section which is fed by three blowers and three exhaust fans at the land building. The reason for the exception is because there is a noticeable difference between the amount of gas exhausted by the automobiles going down grade and those going up grade.

The motors can be controlled from any one of three points: (1) a local control station near the motor; (2) the switchboard in the building in which the motor is installed; (3) the supervisory switchboard in the administration building.

Mono-Bear Diversion Plan Becomes a Reality

Southern California Edison Company Adds 182,000 Acre-Feet to Its Big Creek-San Joaquin Water Supply, Feeding Five Plants

BRINGING to a successful conclusion one of the most difficult pieces of engineering yet accomplished on its world-renowned Big Creek-San Joaquin River hydro-electric project in the High Sierras of Fresno County, the Southern California Edison Company on Nov. 17 turned the water through the Mono-Bear diversion system, making 182,000 additional acre-feet of water available for use through its entire series of five power plants. This work has all been under the direction of George C. Ward, whose work in connection with hydro-electric development has received recognition from the United States Chamber of Commerce and the University of Southern California.

Mono and Bear Creeks are situated across a mountain ridge from the San Joaquin River, on which river much of the construction work of the Edison company's hydro-electric project has been done. Through the construction

of diversion dams on both Mono and Bear Creeks and the boring of two converging tunnels it has been possible to bring all of the water from these two streams to the head of a long inverted siphon stretching across the bed of the South Fork of the San Joaquin River and thence to the Florence Lake tunnel. In planning for this great water reclamation project the company took into consideration the fact that it had but seven months each year in which to carry on the work, and all effort was used toward bringing it to completion prior to Dec. 1, 1927. This work was carried on at an altitude of approximately 7,000 ft., and from the first of December to the end of May the climate is such as to prevent labor in the open. Beginning with the opening up of the trails in the spring of 1926, a construction force numbering at times more than 1,500 men worked at top speed, until early snow forced them to quit in the fall of 1926. Starting again at the earliest possible date last spring, they have now accomplished their aim and the gates at the diversion dams on the two creeks have been thrown open.

More than 11,000 ft. of tunnel, with a cross-section of 7 ft. by 9 ft., was bored, and almost four miles of steel pipe was laid. This pipe varied in diameter from 6 ft. to 8 ft. To carry it to its place on the line it was necessary to construct more than 8 miles of road through rugged mountainous country. Because of the uneven nature of the territory in which this work was being done, very little storage space was available, and at no time was there more than a two to three days' supply of pipe on the ground at the siphon site. This meant that the transportation department, operating a great fleet of heavy-duty trucks hauling great lengths of pipe into the mountains, had to function faultlessly.

In bringing these two streams into subjection the Edison company has brought into use, as stated above, an average yearly run-off of 182,000 acre-feet. The capacity of the Mono-Bear siphon is 600 sec.-ft., or 3,000 miners' inches, which is 50 per cent greater than the maximum capacity of the Los Angeles Aqueduct. In twenty-four hours the siphon can deliver close to half a billion gallons of water into the company's great storage reservoirs. Translated into electrical energy, this tremendous flow of water means that the Southern California Edison Company has 760,000,000 kw.-hr. available annually. In significance this particular task ranks second only to the bringing into use of the record-breaking Florence Lake Tunnel, the 13-mile bore which was completed in February, 1925. The cost of the division was about $5,000,000.

New England Utilities Repair Damage

Service of Light and Power Companies Interrupted by Flood Is Now in Great Measure Restored—Vermont Properties Are Working Under Heavy Handicaps

REMARKABLE progress toward the restoration of normal service has been made in the past few days by New England utility companies operating in the zone of the flood described in last week's issue of the ELECTRICAL WORLD. Later reports from Vermont indicate that the damages sustained by hydro-electric plants and lines will be considerably under the totals feared at the height of the deluge. Engineers and construction forces are already in the field and work is being pushed hard to effect at least temporary repairs on a large scale betore winter sets in. No loss of life in the electrical industry occurred beyond that previously reported. Transportation is greatly disorganized throughout a large part of the state, considerable sections of railway being broken on both trunk and branch lines, with heavy loss in bridges. Highways are also destroyed in many localities, and these conditions are handicapping the flow of fuel oil and many other supplies of engineering importance into the interior of the state. Electrical men in Vermont and New Hampshire, however, are working like beavers to restore normal service as soon as possible, and it is a fair estimate that service will be 75 per cent restored in Vermont and probably 90 per cent in New Hampshire by the time these lines are read.

Service on the system of the Vermont Hydro-Electric Corporation has now attained about 80 per cent of normal. The Pittsford, Mendon, Perkinsville and Cavendish hydro-electric stations are in operation, and all transmission lines are in service. The Glen and Carvers Falls stations are not in service, but will go back as soon as temporary repairs can be completed in their hydraulic works. Machinery has been dried out in flooded plants and substations, and the Cleveland Avenue substation and operating headquarters at Rutland is doing business as usual. Street-lighting service has been restored in the Rutland district, and all important communities served by this company are now receiving electrical energy. The interconnection with the New England Power Association system south of Claremont is being utilized as usual, and extra power is being supplied to make up for the shutting down of Glen and Carvers Falls. It is estimated that the cost of temporary repairs on the Vermont Hydro-Electric system will be about $100,000 and that permanent repairs can be made for about $300,000.

On the system of the Twin State Gas & Electric Company the Berlin division in New Hampshire is being supplied with energy through interconnection with the Brown Company, and repairs are being pushed on the hydraulic works of the Gorham station. The St. Johnsbury division is being served again by the Gorham tie line, and three of the local stations in the former district are now working. About $50,000 loss was sustained at Gorham, and it is estimated that temporary rehabilitation at St. Johnsbury can be completed for about $15,000. The steam plant at St. Johnsbury was flooded and the stack swept away by a house which floated down the Passumpsic River, but the equipment suffered little damage beyond wetting down. About two weeks will be required to restore service from another flooded plant at St. Johnsbury, but here as in many other sections it is anticipated that the work of rehabilitation will be accompanied by engineering studies of the economic possibilities of improved development, small individual stations in certain cases being superseded by a new and larger single installation of greater efficiency on both the hydraulic and electrical sides.

At Brattleboro, Vt., the damage sustained was trifling to the Twin State system. On the Bennington division a small dam was lost. Service has been substantially restored on the Bradford (Vt.) system, but at last accounts the plant of the International Paper Company at Wilder had not been able to resume generation. The Fairfax Falls plant of the Public Electric Light Company, which serves the St. Albans district and delivers energy to a part of Burlington, was shut down on account of high tailwater and has now resumed service.

Conditions in New Hampshire are close to normal for the most part, and western Massachusetts utilities are operating as usual, although the town of Becket, on the Westfield River, was virtually wiped out by the flood and electric service has not at this writing been extended to it.

As on the Deerfield River, the public utility dams in other parts of Vermont proved of utmost value in reducing flood losses and no dam of major importance failed. Dean W. J. Votey of the University of Vermont School of Engineering and Dr. J. A. Rogers, chairman of the Vermont State Board of Health, declared that the public utility dams saved the state from far more serious damages and that the city of Rutland was protected by the Chittenden dam in particular from a disaster of much greater proportions.

D. W. Jardine, manager of the Burlington (Vt.) Light & Power Company, reports the damage at that point to be less than at first estimated and reconstruction to be proceeding rapidly. The chief trouble is from wet apparatus. Present load at Burlington is about normal, 2,500 kw. to 3,000 kw. At the Essex plant the units are running without load to dry them out, and it is expected that two of them will pick up load on Sunday and that all seven of the hydro-electric generators at the Essex and Gorge stations will be ready for service next week. The Burlington end of the Montpelier transmission line is ready for service, and all other work except the generator dry-out and two

permanent crossing towers will be completed Sunday.

Conditions at Montpelier are gradually improving. The Molly's Falls hydro-electric station is carrying the Montpelier and Barre load, the pioneer steam plant being held in reserve on account of the inability of the railroads to move fuel oil into the district. It is hoped to restore the Bolton Falls plant in a few weeks.

Springfield Company Publicly Praises Employees

"That Springfield's homes, streets and industries were not deprived of light and power during the recent flood was due largely to the alertness, indomitable pluck and tireless efforts of our loyal employees, working side by side with the employees of Stone & Webster, and the directors of this company wish to go on record as giving unstinted praise for their heroic efforts in stemming the tide of the greatest onrushing of water in the history of Springfield." In these words, the opening paragraph of a double-column advertisement in the local newspapers, the United Electric Light Company of Springfield, Mass., paid tribute, as the swollen Connecticut River began to subside, to the work of its men in maintaining service. The advertisement went on to tell in more detail how "every man in our organization—superintendents, foremen, assistants, helpers and all—worked as if defending their own homes," concluding: "To them we give all the credit, and to their heroic devotion to duty the whole city of Springfield owes a priceless debt of gratitude."

Jobbers Authorize Distribution Research

Detroit Convention to Be Followed by One Next Summer at Which Managing Director Rogers Will Make Recommendations—Independent Jobbers' Club

A FUNDAMENTAL study of the economics of distribution of electrical manufactured products was authorized this week at the annual winter meeting of the Electrical Supply Jobbers' Association, held at the Book-Cadillac Hotel, Detroit, Wednesday to Friday. As a result of the reorganization of the association accomplished at its May meeting, its national headquarters is to be moved from Chicago to New York, and the announcement that Granville P. Rogers has been appointed managing director, already noted in the ELECTRICAL WORLD, was made. Mr. Rogers will apply his energies for the time being to an intensive study of the present status of distribution in the electrical industry and the problems now confronting the jobber. Recommendations based on this research will be reported for action at the next meeting of the E.S.J.A., to be held in Hot Springs, Va., early next summer.

There was an unusually representative attendance at Detroit, evincing the keen interest of the jobbers in this program. Alex Dow, president of the Detroit Edison Company, welcomed the convention, and the formal program was participated in by Alvin E. Dodd of the United States Chamber of Commerce, who spoke on "Facing the Facts in the Distribution Situation"; John C. Jones, vice-president of the Alexander Hamilton Institute, who discussed the future of the jobbers, and W. E. Sprackling, president of the Tubular Woven Fabric Company, who presented the industry situation that is crystallizing in the industry sales conference to be held in New York next week. Earl Whitehorne, commercial editor of the ELECTRICAL WORLD, talked on "The Next Big Problem," analyzing the present market situation in the electrical industry and the need for more aggressive selling by all its branches.

The independent jobbers' group held a meeting and appointed a committee to establish formally an Independent Jobbers' Club within the membership of the association and proceed systematically to the careful study of the group problems and interests of the independent jobber.

O. Fred Rost of Newark, N. J., was made the recipient of the James H. McGraw award for signal service to the jobbers' branch of the industry, as told in detail on page 1069.

Birmingham Votes to Discontinue Municipal Plants

By a vote of about two to one the citizens of Birmingham went on record on Tuesday as favoring the sale of the municipal water and electric light plants to public utility companies. Interest in the election was very slight, only three thousand citizens voting out of two hundred thousand. The Birmingham Electric Company and the Birmingham Waterworks Company together offered approximately $650,000 for the two plants, and the City Commission plans to spend the money for permanent improvements.

Sale of the plants was advocated on the grounds that more efficient operation could be had with private ownership and conduct, that the city would be saved a considerable loss each year in operating expenses and that the city would be benefited by having the value of the plants placed in permanent improvements. The movement to have the plants sold was started by the Merchants' Association of North Birmingham, where the plants are situated. The price was fixed after investigation by disinterested experts.

Electrical Credit Association Division Meetings

Two division meetings of the National Electrical Credit Association have been held this month—the Middle and Southern Atlantic States Association's at Philadelphia Nov. 11 and the Central Division's at Milwaukee Nov. 17 and 18. The chief address at the Philadelphia meeting was made by William C. Schluter of the University of Pennsylvania on "Why with a Reported Heavy Turnover Are Profits Meager?" This was followed by a prepared discussion in which seven members of the association took part.

At Milwaukee Edwin Herzberg was scheduled to speak on Friday on "Problems of the Contractor-Dealer"; Earl Whitehorne on "What Is the Matter with the Credit End?" and F. B. Uhrig on "The Job." A member of the legal profession, manufacturers' representatives and a Department of Commerce specialist were to discuss various practical problems.

N.E.L.A. Sets Up Oil-Burner Committee

Announcement is made that the new national oil-burner committee appointed by the president of the National Electric Light Association under the chairmanship of F. A. Coupal, Buffalo, Niagara & Eastern Power Corporation, will embrace these members: M. E. Skinner, Mohawk-Hudson Power Corporation, Albany, N. Y.; H. E. Young, Northern States Power Company, Minneapolis; A. K. Baylor, General Electric Company, New York; C. K. Nichols, New York Edison Company, and Earl Whitehorne, ELECTRICAL WORLD. This committee will work in co-operation with one appointed by the Oil Burner Institute and containing W. E. Simpson (chairman), New York; C. U. Williams, Bloomington, Ill.; W. C. McTarnahan, New York; H. Finnie, Canton, Ohio, and H. F. Tapp, New York.

International Radio Conference for Arbitration

Compulsory arbitration in international radio disputes has been indorsed by the convention committee of the International Radiotelegraphic Conference at Washington by a majority of ten votes, including that of the United States. This action registers a change in the American attitude believed to have been brought about by federal executive influence. Great Britain, Japan, Australia, the Irish Free State, British India and Egypt are understood to have opposed compulsory arbitration. The fight for it was led by Argentina, supported by the smaller nations of America and Europe.

It has been agreed to exchange ratifications at Washington when the new convention is ready. If confirmed, the agreement is to be effective from Jan. 1, 1929.

Purchases and Mergers

Consolidations in Alabama, New York, Pennsylvania and Other States—More Municipal Light Plants Surrender, Others Stand Proudly Aloof

CONSOLIDATION of the Alabama Power Company, the Gulf Electric Company and the Houston Power Company into one company, to be known as the Alabama Power Company, was effected on Nov. 10, at a meeting of the stockholders of the organizations in Birmingham. The Alabama Power Company's lines have been connected with those of the other companies for some time and the act of consolidating the companies involves merely the changing of ownership and management. The Gulf Electric Company operates plants in Mobile and other towns in southwest Alabama. The Houston Power Company supplies several towns in south Alabama.

The New York State Gas & Electric Corporation has made application to the Public Service Commission for authority to acquire all of the outstanding stocks of the Plattsburg Gas & Electric Company and the Harlem Valley Electric Corporation, now serving various municipalities in the eastern and northeastern part of the state, and to merge them into the New York State Gas & Electric Corporation. Associated interests already own all the outstanding stock of the three companies.

Merger of the Keystone Power Corporation of Ridgway, Pa., with its controlling company, the West Penn Electric, is understood to have taken place.

Permission has been granted by the Maryland Public Service Commission to the Maryland East Coast Utilities, Inc., to acquire the Electric & Ice Manufacturing Company, and to the East Coast Utilities Company to acquire in turn the Maryland East Coast Utilities, Inc. The commission has also approved the acquisition of the Citizens' Light, Heat & Power Company of Salisbury by the Associated Maryland Electric Power Corporation for $20,580.

Three more Kansas communities have been added to the list of those abandoning municipal electric service in favor of central-station energy, the towns of Delphos, Nickerson and Sylvia having entered into contracts with the United Power & Light Corporation, with headquarters at Abilene. Clearwater, Kan., however, has voted not to accept a proposal to take electric service from the Kansas Gas & Electric Company, Wichita.

The Consumers' Public Service Company, with headquarters at Brookfield, Mo., has filed application with the Missouri Public Service Commission to purchase the Browning-Purdin Electric Company, the Laclede Electric Light Company and the Rothville-Sumner Electric Company, which operate plants at Browning, Purdin, Humphreys, Osgood, Harris, Newton, Laclede, Rothville and Sumner, in the north central part of the state, for $135,000.

New Hampton has been added to the chain of cities served with electricity and power by the Missouri Public Service Company, which has taken over the New Hampton Electric Company.

A proposal for the issuance of $60,000 of municipal bonds for the purchase of the electric light plant of the Lawrence County Water, Light & Cold Storage Company, will be submitted to the voters of Aurora, Mo., on Dec. 6.

A proposal for the purchase of the city of Williston's electric power and light distributing system for $80,000, or a sum as much in excess thereof as may be named by the North Dakota Board of Railroad Commissioners, has been made to the City Council by the Montana-Dakota Power Company with the request that the matter be referred to the voters of the city at a special election. The company's plans include the construction of a gas-fired generating plant at Williston and a reduction of the maximum rate from 13 cents to 10 cents a kilowatt-hour.

The Otter Tail Power Company of Fergus Falls is negotiating with the villages of Evansville, Brandon, Garfield, Erdahl and Asby, Minn., for the purchase of power lines.

Voters at Harlingen, Tex., have defeated by a heavy majority a proposal to sell the municipal light and water plant to the Central Power & Light Company for $1,250,000.

At Charleston, Miss., where the Mayor and City Commission had agreed to sell the city light and water plant to the Mississippi Public Utility Company for $100,000, the citizens have repudiated the bargain at the polls, this being the second time that they have voted to continue their plant.

The Pacific Light & Power Company has purchased the electric distributing system of the town of Fossil, Ore., and will extend its high-tension line from Condon to Fossil, a distance of about 41 miles.

The proposed merger of the Connecticut Light & Power Company with the Bristol Electric Company and the Middletown Gas Light Company, Connecticut utilities, was under discussion at a recent commission hearing. The capital stock of the Bristol and Middletown utilities is owned by the Connecticut Electric Service Company, which also controls the Connecticut Light & Power Company. Objections to the proposed plan of financing were expressed, and final decision was reserved.

No merger is pending and none is contemplated between the Lehigh Power Securities Corporation and the Electric Power & Light Corporation, according to an announcement made by the Electric Bond & Share Company, which company acts in a supervisory capacity for both.

Federal Power Commission's Report

Applications Maintain Six-Year Numerical Average—State Rights Recognized—Opposition to Bill Limiting Scope as Regards Navigable Streams

NINETY-SEVEN applications were filed with the Federal Power Commission in the past fiscal year, says the seventh annual report of that body, just made public, of which 64 were for licenses. Together with thirteen other applications for license by holders of preliminary permits, these petitions involve a prospective installation of approximately 3,300,000 hp. In number they compare evenly with those in other years, the average having been 100 ever since the end of the first year's rush that followed the passage of the water-power act.

Among the most noteworthy of the new applications in point of capacity are the New River project of the Appalachian Electric Power Company, with a proposed installation of 100,000 hp., and the Savannah River project of the Savannah River Electric Company, of 120,000 hp. Particular interest attaches to certain applications in Alaska because of the plan to develop the water power in extensive pulp and paper mill operations utilizing large blocks of national forest timber. Likewise the application of the Potomac River Corporation for a comprehensive development of the Potomac River from its upper tributaries to tidewater has aroused unusual interest because of its relation to plans for the park development of the national capital and to proposals which have been under consideration in Congress for many years for constructing these developments at the expense of the United States.

Thirty-one new projects having an installed capacity when completed of 362,000 hp. have been started during the fiscal year, bringing the total of projects completed or under construction at the close of the year up to 128 with a proposed aggregate installation of 4,610,000 hp. The largest of the new projects for the year are the Carolina Power & Light Company's Pigeon River project in North Carolina, with an ultimate capacity of 105,000 hp., and the Chelan Electric Company's project on Lake Chelan, Wash., with an ultimate capacity of 110,000 hp.

The commission once more complains of its inadequate personnel, which, it says, prevents it from maintaining an adequate check on construction costs in order that the capital accounts of licensees shall contain only the "actual legitimate investment" which the water-power act prescribes. Doubtful items have been found, but the commission cannot with its present personnel make the investigations and conduct the hearings necessarily preliminary to the issuance of appropriate orders in these cases, and, in consequence, millions of dollars may be improperly entered in fixed-capital accounts of licensees.

State Jurisdiction

Co-operation in federal and state development of water power is urged by the commission, its report following the lines of the paper read by Executive Secretary O. C. Merrill before the Southern Appalachian Power Conference at Chattanooga, Tenn., and abstracted in the Electrical World for Oct. 22 (page 855). "Whatever may be the basis which has been deemed to be the most effective or expedient in any particular state, there appears to be ample authority in each of the states to exercise such supervision or regulation over water-power development as may seem to them to be in the public in-

terest," the commission says. It declares:

One principle that should be established and maintained is that values inherent in a public resource developed and used in the performance of an essential public service by an agency created by law for that purpose shall not be capitalized for purposes of sale, of establishment of rates, or of issuance of securities, in an amount in excess of actual reasonable cost. One way in which this principle can be maintained with certainty is for the public to retain in perpetuity the ownership of these resources to which it has title and to retain it through that public agency which has the title. It happens that the title to power sites having potentialities of scores of millions of horsepower is in the federal government. It alone has the means for retaining these sites in public ownership, and it has through the federal water-power act evinced the intention to retain them perpetually. A similar situation exists where the states hold title to the beds and banks of streams or to other lands or properties necessary to make a water-power development. Adequate protection of the public interest requires that the states likewise forever retain the title to such properties.

There are other instances, as, for example, on the navigable streams, where the title to riparian lands, and sometimes to the bed of the stream, is in private ownership. In such cases the grant of authority to make the development is in the nature of a franchise which, at least as far as the jurisdiction of the federal government exists, may be granted or denied. This right to grant or to decline to grant carries with it the right to grant under conditions, and, in accordance with the decision of the United States Supreme Court rendered on May 21, 1927, in the case of Fox River Paper Company et al. vs. Railroad Commission of Wisconsin, such grant may apparently be made conditional on a limitation of land and water-right values to amounts determined by the granting agency, the court saying in this case that compliance with provisions contained in the state law "is the price which the plaintiffs must pay to secure the right to maintain their dam." In only a minority of cases can such condition be fixed through the necessity of securing the consent of the United States. But the state would appear to have ample authority to place limitations on land and water-right values either through the means adopted by the State of Wisconsin or as a condition to the exercise of the right of eminent domain. . . .

Notwithstanding the present tendency toward interconnection and the extension of great power systems over the territory of several states, power development, after all, is primarily a state problem over which the states should assume the major responsibility.

Opposes Restriction of Scope

Dealing with power development in relation to interstate and foreign commerce, the report refers to bills introduced into the late Congress modifying the existing definition of "navigable waters" as contained in the water-power act and making the commission's jurisdiction narrower with respect to such waters than is the jurisdiction of Congress. Should this proposed legislation pass, the commission's report says—

such a condition of uncertainty will exist with respect to those streams as to be a serious hindrance to their development. The expenditures involved in modern hydro-electric development are too large to permit of financing unless the right to continued use of the stream under known and fixed conditions is assured. In absence of a provision such as is now contained in the law, it would be necessary for those proposing power developments on streams whose status with respect to navigation is doubtful either to secure authority for such development by special act of Congress or to abandon such development altogether.

It is the opinion of the commission that in all cases where federal authorization is necessary for power development in streams of the United States, such authorization should be given under the provisions of the federal water-power act, and that it would be a mistake to modify that act so as to withdraw from its provisions any prospective power developments which if so withdrawn would require that authorization for their development be secured by special act of Congress or through action by the War Department under prior legislation; and since the provision now contained in the federal water-power act makes possible power development on streams of doubtful status under conditions which protect the interests of interstate and foreign commerce as well as those of the applicant, it is likewise the opinion of the commission that the repeal of the provision either outright or by indirection would be a serious mistake.

Seattle Department Quits the Sale of Small Appliances

Following the example of the Puget Sound Power & Light Company (noted on Nov. 5, page 958) and carrying out the policy recommended by Mayor Bertha K. Landes, the light department of Seattle will discontinue the sale of small electrical merchandise, although it will keep on selling electric ranges, heaters and lamps. The announcement of the change in policy, made by Superintendent J. D. Ross, has met with the approval of the City Council. Electrical contractors, however, have strongly opposed the sale of ranges by the city, and their viewpoint has therefore not been met.

Pasadena Will Not Discontinue Sale of Lamps

Despite the request of the Pasadena Merchants' Association that the power and light department of that California city refrain from the sale of electric lamps at cost price, the Board of City Directors hold it expedient to continue the long-established practice. The Merchants' Association declared that the sale is not a "proper governmental function" and that the city should discontinue what the association terms "the unfair and unprofitable practice of selling electric light bulbs." Chairman Taylor of the Board of City Directors replied: "We realize that the lamp situation is a mixed question. The merchants had a right to make their request, and in conjunction with the city manager the board discussed the matter and feels that it is best not to make a change. The service is maintained at the cost of the taxpayers. Out-of-town residents, however, have availed themselves of the opportunity to get Pasadenans to buy lamps for them. The city will take steps to guard against that practice and will limit the sale of lamps to Pasadenans."

National Power Show Will Be Held Dec. 5-10

The sixth annual National Exposition of Power and Mechanical Engineering is to be held at the Grand Central Palace in New York during the week commencing Dec. 5, paralleling the annual meetings of the American Society of Mechanical Engineers and the American Society of Refrigerating Engineers. Power generation will, as usual, occupy a large section with displays of boilers, stokers, furnaces, superheaters, valves and accessory devices. In the planning and conduct of the exposition the management is aided by an advisory committee including in its personnel I. E. Moultrop, Edison Electric Illuminating Company of Boston, C. F. Hirshfeld, chief of the research department, Detroit Edison Company; E. B. Katte, chief engineer electric traction, New York Central Lines; John H. Lawrence, Thomas E. Murray, Inc., New York; Charles M. Schwab, president American Society of Mechanical Engineers, and other prominent men.

Coal Stocks on Oct. 1 Nearly 62,000,000 Tons

That coal stocks, as reported by the Bureau of Mines, should have aggregated 61,900,000 tons on Oct. 1 came as a surprise to most observers in Washington. Some are at a loss to understand how a reduction of only 1,500,000 tons had taken place during the quarter when the central competitive field was nominally on strike. It is believed, however, that the total reported by the Bureau of Mines cannot be challenged successfully. The bureau received reports in writing from all the by-product steel works, from all the large railroads (through the American Railway Association), from 573 electric utility plants, from 240 coal-gas works, from 2,092 industries and from 887 retail coal dealers. The total covered by the actual reports from large consumers was 43,237,808 tons. This provides an adequate basis from which to calculate the stocks held at many thousands of smaller industrial plants and by retail dealers. It should be understood that there are 90,000 carload buyers of coal.

Those who had figured on a smaller total apparently overlooked the fact that domestic consumption and exports during the quarter were comparatively low, while production increased steadily. The draft on stocks noted during the first three months of the strike continued during July, but in August production began to pass consumption and 1,800,000 tons were added to stocks.

Briefer News

VALMONT STATION DISTRIBUTION SYSTEM EXTENDED.—The Public Service Company of Colorado on Nov. 8 started to erect power lines between Brush, Colo., and the Weldon valley, a distance of 22 miles. With a tie-in at Kersey this will connect the section with the company's Valmont power station.

DATES FOR A.I.E.E. REGIONAL MEETINGS.—Dates for the earlier 1928 regional meetings of the American Institute of Electrical Engineers have been fixed as follows: St. Louis, March 7-9; Baltimore, April 17-19; New Haven, May 16-18 (probably). Precise dates for the meetings at Spokane in August or September and in the South in October or November are still unsettled.

SOUTHERN UTAH COMPANIES TO BE INTERCONNECTED.—Permission has been granted by the Public Utilities Commission of Utah to the Dixie Power Company and the Telluride Power Company, both operating in southern Utah, to interconnect their lines through the construction of a substation and a transmission line about 35 miles long. Details of their application were noted in this column on Oct. 8 (page 757).

NAPA, CAL., TALKING OF MUNICIPAL PLANT.—Agitation for a municipal light and power plant at Napa, Cal., has led to a consideration of the idea by the City Council. Napa, a city of about 7,000 people, is served by both the Pacific Gas & Electric Company and the Great Western Power Company. Certain prominent citizens visualize a great saving in cost through municipal service, and a committee will, it is said, "look into the matter from every angle."

RURAL-LINE CONSTRUCTION IN NEBRASKA.—Several Nebraska companies are constructing lines into new territory to serve rural communities and farmers, and among these the Nebraska Power Company is particularly active. It is building four short lines in Cass County, will construct another from Gretna, will build out of Ashland to serve Memphis, Wann and Yutan, and erect still another line to serve Richfield and Springfield.

SIOUX CITY ELIMINATES RESIDENTIAL POWER METERS.—New electricity rates initiated for the purpose of eliminating the separate power meters in Sioux City, Iowa, have been announced by W. J. Bertke, vice-president of the Sioux City Gas & Electric Company. Electricity will henceforth be provided for both light and power at a rate of 5 cents a kilowatt-hour, the present rate for power, plus a meter charge of from $1.50 to $3 according to the size of the meter. This will eliminate the charge of 9 cents a kilowatt-hour for energy for lighting. "With the advent of the electrically driven refrigerators," Mr. Bertke said, "more applications have come for the power meter, and in order to eliminate the expense of the extra wiring we are offering the new rates. The $1.50 charge covers a 5-amp. meter, which is used in almost all residences."

PROPERTY OWNERS WILL PAY FOR NEW STREET LIGHTING IN DOWNTOWN SEATTLE.—Construction and reconstruction of the street-lighting system in the entire business district of downtown Seattle, at an estimated cost of more than a million dollars, has been approved by the City Council. Present plans call for three-lamp standards on Second Avenue and on Union, Pike and Pine Streets and two-lamp standards on all other streets. The entire cost of the project will be borne by the property owners.

MILLEDGEVILLE SUBSTATION HELPS GEORGIA POWER SYSTEM.—A new substation of the Georgia Power Company just completed at Milledgeville will, according to R. J. Wilson, district manager of the company, complete another tie-in with the hydro-electric system which is being extended over the state. A 66,000-volt line is being run to Gordon, Stevens Pottery, McIntyre and other points south of Milledgeville through the substation, carrying unlimited power from Tallulah Falls, Augusta and Aiken. A two-way service will be maintained.

MIDVALE, UTAH, GREETS "WHITE WAY."—Citizens of Midvale, Utah, and surrounding territory served by the Utah Power & Light Company turned out en masse on the evening of Nov. 4 and celebrated with enthusiasm the dedication of the city's new "white-way" lighting system, one of the finest installations to be found in a small town anywhere in the West. This system consists of 44 standards of "Hollow-spun" concrete, 13 ft. 6 in. to center of lamp, with 600-cp. lamps and "Bi-Lux" refractors. The units are of the old English horned or spiked lantern type. The new lighting covers five blocks in the main business section and is a Westinghouse installation. It has already given an impetus to business activity.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see the ELECTRICAL WORLD for July 2, page 50.]

National Electrical Manufacturers' Association — Radio Division, Edgewater Beach Hotel, Chicago, Nov. 28-Dec. 1; Supply Division, Hotel Commodore, New York, Jan. 23-30. S. N. Clarkson, 420 Lexington Ave., New York.

American Physical Society—Chicago, Nov. 25-26; Nashville, Dec. 28-30. H. W. Webb, Columbia University, New York.

American Institute of Electrical Engineers — Regional meeting Great Lakes District, Drake Hotel, Chicago, Nov. 28-30; winter convention, New York, Feb. 13-16. F. L. Hutchinson, 33 West 39th St., New York.

National Association of Utility Secretaries—Oklahoma City, Dec. 5-7. E. F. McKay, 307 Local Bldg., Oklahoma City.

American Society of Mechanical Engineers—New York, Dec. 5-8. C. W. Rice, 29 West 39th St., New York.

National Electrical Credit Association —New York Division, Dec. 13. W. J. Kreger, 261 Broadway, New York.

Northwest Association of Electrical Inspectors—Olympic Hotel, Seattle, Jan. 26-28. F. D. Weber, 414 Lumbermen's Building, Portland, Ore.

DYNAMITES OLD STEAM MACHINERY OUT, RUSHES ELECTRIC EQUIPMENT IN.—Electric power and equipment served an exact purpose in the city of Salem, Ore., recently when, with an enormous amount of lumber to be delivered, the steam-power plant of the Spaulding lumber mills suddenly broke down and the firm literally dynamited the old machinery out of place and installed in its stead an electric power plant. It required but two days to place the mill in operation again, and forty days would have been wasted in waiting for new steam equipment.

MISSOURI RIVER POWER FOR SOUTH DAKOTA.—A recommendation that the State Engineer be authorized by the next session of the Legislature to gather data on several natural water-power sites on the Missouri River in South Dakota has been made by Louis N. Crill, State Secretary of Agriculture. Mr. Crill predicts an increased population and lower electric rates if the power of the Missouri can be harnessed and expresses the belief that there are seven natural water-power sites along the Missouri River in South Dakota which will develop more than half a million horsepower.

EXPECTED EXPANSION OF SAN ANTONIO PUBLIC SERVICE CORPORATION.—The San Antonio Public Service Corporation will in the near future construct either another unit of 30,000 kw. at the power plant of its subsidiary, the Comal Power Company, at New Braunfels or a complete separate plant on the Guadalupe River at McQueen, near Seguin, according to W. B. Tuttle, president of the former company. The proposed improvement will cost approximately $1,500,000, he said. It is not, however, the intention of the company to construct it during the current year.

NEW AIRWAY BEACONS INSTALLED BY DEPARTMENT OF COMMERCE.—One hundred new airway beacons have been or are being installed by the Department of Commerce at Washington along the regular transcontinental airway between Chicago and St. Paul and also along the New York and Atlanta airway. This group follows a similar installation of one hundred which were needed previously for these two airways. They have been placed at intervals of 10 miles along the route. These beacons, furnished by the General Electric Company, are the 24-in. revolving type, which has now become the standard for the air-

ways maintained by the Department of Commerce. They have a beam candlepower of 2,000,000 when used with a 1,000-watt, 115-volt incandescent lamp.

AURORA (ILL.) ELECTRIC UTILITIES REVERT TO LOCAL MANAGEMENT.—With the cancellation on Nov. 1 of its contract with the General Engineering & Management Association, the Western United Gas & Electric Company of Aurora, Ill., of which Ira C. Copley is president, reverted to direct management by its own officials. This company is associated with the Aurora, Elgin & Fox River Electric Company and subsidiary to the Western United Corporation, of which A. E. Fitkin acquired control in 1926, afterward selling his interest to E. H. Rollins & Son, bankers.

SOUTHERN CALIFORNIA EDISON'S HIGH "GET-AWAY" TOWERS.—Unusually high towers have been erected by the Southern California Edison Company at its new Long Beach steam plant to make it possible to carry the transmission lines across Long Beach Channel at a height sufficient to prevent tall-masted vessels striking the lines. The highest pair of towers, at the edge of the channel furthest from the plant, rise 310 ft. above the ground, while beyond them are a pair 265 ft. high. When this line is completed energy will be transmitted at 220 kv. The lines now in use are operated at 60 kv.

CUSTOMER'S VIEWPOINT PRESENTED AT OKLAHOMA MEETING.—The customer's viewpoint of electric service was put before the Eastern District conference of the Electric Light and Power Division of the Oklahoma Utilities Association at Muskogee on Nov. 10 by R. P. Harrison of that city. Executives and employees of electric light and power companies operating in eastern Oklahoma attended the meeting, which included among those asked to address it Mayor Paul Williams of Muskogee, Fred W. Insull and L. P. Arnold of Tulsa, E. F. McKay, Leonard Nelson and M. Barnes of Oklahoma City, R. W. Curran of Bartlesville and Doyle Jurney of Cushing.

FOURTH UNIT AT GREAT FALLS (MANITOBA) PLANT WENT INTO SERVICE NOV. 1.—Announcement was made Nov. 1 by A. W. McLimont, president of the Manitoba Power Company, Limited, that the company has just placed in operation the fourth generating unit at its Great Falls plant, with a capacity of 31,500 hp., bringing the total capacity of the plant to 115,500 hp. An increase of 15,000 hp. in the Winnipeg load, together with the increased production of the Manitoba Paper Company at Pine Falls, insures full load for the new generating unit from the start. Plans are now being prepared for the installation of a fifth unit, which will be of approximately 40,000 hp., Mr. McLimont says. To carry the energy to Winnipeg another steel-tower, two-circuit, 110,000-volt transmission line from Great Falls to a new terminal station which the Winnipeg Electric Company has built in the northwest section of the city has been erected. The transmission line and terminal station represent an investment of approximately $1,500,000. This new line traverses entirely different territory from that of the present transmission line, which is 40 miles distant. Towers where the line crosses the Red River from East Selkirk to West Selkirk are 250 ft. high and 40 ft. square, and the span is 2,047 ft. in length.

FLOODLIGHTING AND ELECTRIC SIGNS IN TOPEKA.—Not content with the possession of one of the most brilliantly floodlighted buildings between the Mississippi and the Rockies, George G. Moore, president of a Topeka (Kan.)

life insurance company, has placed above the structure an electric sign 50 ft. high, 76 ft. long and 17 ft. in depth, with letters, of porcelain enamel, 10 ft. high. Mr. Moore is making plans to floodlight the reverse side of the building, where he has placed a painted sign 85 ft. high.

RATE CONTROVERSY AT ANDERSON, IND., SETTLED.—Another chapter in the long electric rate controversy between the city of Anderson and the Indiana Public Service Commission was written Nov. 5, when the commission vacated its order of Sept. 20, 1926, and promulgated a new schedule of electric rates as recommended by officials of the Anderson municipal electric plant. The order said that the rates adopted in 1926 had been found to impose a hardship both on some consumers and on the city. The new rates will reduce the income of the municipal plant about 20.4 per cent, or $11,187 a year. Litigation pending in the Madison County courts for the last year will be dropped, it is understood.

OIL BELT POWER ADDS 15,000 KW.—The Oil Belt Power Company is enlarging its power plant, 3 miles southeast of Eastland, Tex. The capacity is to be increased from 22,500 kw. to 37,500 kw.

ELECTRIC METER MEN TO GATHER AT LAFAYETTE, IND.—As announced in this column last week, meetings of the N.E.L.A. National and Great Lakes meter committees will be held at Lafayette, Ind., on Dec. 7 to 10, with open meetings on the first two days, to which all interested in metering are invited. The invitation to hold the open meeting in Lafayette was extended jointly by Purdue University and the Duncan Electric Manufacturing Company. An excellent program is being scheduled which should make this gathering one of real educational value. The engineering schools of Purdue University and the factory of the Duncan Electric Manufacturing Company will be open for inspection.

HYDRO PLANT FOR THE HAMMA HAMMA RIVER.—Opening the way for developing a power and paper plant in the Mason County section of the Olympic peninsula, water and reservoir permits for the Hamma Hamma Power & Paper Company of Olympia have been issued by the Washington Hydraulics Supervisor. Headed by Ed M. Chandler of Olympia as president, the new company, which will benefit by a fall of water of 490 ft., plans not only to operate a paper mill but also to sell the surplus of the 19,000 hp. to utility companies. The plant, which will cost $1,500,000, will be assured of shipping facilities through its location on an arm of Puget Sound and a primary trunk highway. The allotment allowed by the state consists of 350 sec.-ft. of water from the Hamma Hamma River and reservoir rights for the storage of 15,800 acre-feet. The diversion dam, in a steep canyon, will be 147 ft. in height, 40 ft. wide at the bottom and of concrete construction. Construction will be started within two years, it is announced.

DALLAS MEN VISIT TRINIDAD POWER PLANT.—Business men and public officials from Dallas to the number of 150 were taken to Trinidad, Tex., on Nov. 3 as the guests of the Texas Power & Light Company to inspect the lignite-burning plant there. The delegation was in charge of John W. Carpenter, vice-president of the company. The Trinidad plant was inspected from top to bottom, the Dallas men being shown how 25 carloads of lignite a day are ground to powder and fed to the four boilers by one attendant. Especial interest was evinced in the 300-ft. concrete smokestacks, which have their base on the roof of the plant above the boilers, 100 ft. above the ground. The two turbo-generators of 20,000 kw. each are, Mr. Carpenter explained, eventually to form only one-fourth of the generating station. Other features of the plant that interested the visitors were the 17,000-ton pile of ground lignite held

in reserve, the 650-acre lake stocked with all kinds of fish, the control building, the transformers and oil switches and the model village for employees.

ELECTRICAL-INDUSTRIAL SURVEY OF TEXAS-LOUISIANA TERRITORY.—A survey of 32,125 square miles of territory of northeastern Texas and northwestern Louisiana is being made by Burt C. Blanton of Dallas, industrial engineer, and a large staff of assistants for the East Texas Public Service Company and the Southwestern Gas & Electric Company, controlled by the Insull interests of Chicago. The primary purpose of the survey is to determine the possibilities of the use of electric power in the territory covered, though the data will also be available for other industrial purposes. The report will treat in an exhaustive manner the specific advantages of the area as a whole and also of certain communities for the location of new industries.

HIGH ROCK (N. C.) DAM CLOSED.—The power dam at High Rock, N. C., which will cause the formation of one of the largest artificial lakes in the South, was closed on Nov. 10 after a delay caused by the necessity of rerouting railroad tracks. The water will cover approximately 20,500 acres of land in Davidson and Rowan Counties, and the lake, when full, will have a shore line of approximately 266 miles. Water will be backed up to Abbott's Creek at Lexington, N. C., which is 20 miles from the dam, and the lake will extend even farther up the Yadkin River. Completion of the dam to the point where the bottom can be closed in approximately thirteen months from the time when the first concrete was poured is believed to have set a record for such construction. The dam is approximately 1,200 ft. long. The plant, which will generate about 44,000 hp. at the dam, is being built by the Southern Power Company for the Tallassee Power Company. The Southern Power Company will use all the output.

NORTH CENTRAL COMMERCIAL SALES CONFERENCE.—An excellent program presented by central-station, Westinghouse and General Electric men was put before the annual conference of the commercial men of the light and power industry in Minnesota, North and South Dakota at Minneapolis on Nov. 11 and 12. The subjects covered embraced commercial cooking, competitive power, customer relations, domestic electric ranges, general merchandising, home lighting, industrial heating, refrigeration, street and highway lighting, transportation and wiring. J. E. Davidson of Omaha, Frank E. Watts of New York, C. J. Strike of Huron, S. D., and other well-known electrical men were among the scheduled participants. The North Central Division of the N.E.L.A. held state meetings at Huron, S. D., in October and Devil's Lake, N. D., in September, which both drew a large attendance, and an accountants' meeting in Minneapolis last month, called the best in years.

Commission Rulings

COMMISSION DEFENDS AMHERST (MASS.) RATES.—A customers' petition asking that the Amherst Gas Company make further reductions in the service rates for electricity was recently dismissed by the Massachusetts Department of Public Utilities. In finding for the company the commission called attention to the fact that customers had received a reduction of 1.1 cents per kilowatt-hour from June 1. It said that a summary of the kilowatt-hours sold disclosed that a large portion of the electric service was for rural lighting in territory where increases in sales had been relatively small for several years. The company has paid a 6 per cent dividend yearly except in 1926, when the dividend was 6¼ per cent.

"ACTIVE-ROOM" RATE SCHEDULES IN INDIANA.—The city of Martinsville established its right to demand a general reduction of electric light and power rates and to oppose the application of the "active-room" schedule of rates proposed by the Wabash Valley Electric Company when the Indiana Public Service Commission overruled a motion by counsel for the utility to have a petition by patrons of the light and power company and an intervening petition by the City Council dismissed. Results of experiments with the "active-room" schedule at Martinsville and Huntington are not complete enough, according to the power company attorneys, to justify a decision. After a preliminary investigation members of the commission announced that they were not entirely convinced that the principle would bring about general reductions or be satisfactory and that they perceived many objections to a rate schedule in this form.

Recent Court Decisions

NO RIGHTS CAN BE CLAIMED UNDER FRANCHISE REPEALED BEFORE IT TOOK EFFECT.—The Court of Civil Appeals of Texas has held, in Northern Texas Utilities Company vs. Community Natural Gas Company, that no rights were acquired under an ordinance purporting to grant a franchise which would not become effective until 30 days after the date of its last publication and which before that time had been repealed by the City Council. A city may, the court said, make a franchise conditional upon the commencement and completion of work by the company within a specified time. (297 S. W. 904.)*

ANTI-SERVICE-CHARGE LAW DECLARED UNCONSTITUTIONAL.—The United States District Court for the Western District of New York has declared an anti-service-charge law passed by the New York State Legislature in 1923 to be arbitrary, confiscatory and unconstitutional, its decision affecting immediately rates for gas enforced by the Niagara Falls Gas & Electric Company with the support of the New York Public Service Commission. The United States Light & Heat Corporation, a large manufacturer of storage batteries, wished to use gas for fuel instead of coal or oil. It could not afford to do so at the flat rate of $2.35 for gas then in force. The gas company tried to change its form of rates so as to require all customers to pay a service charge and thereby enable the giving to substantial users of gas a rate which reflected only the cost of servicing them. The commission had to reject this schedule and enforce the 1923 statute. The manufacturer brought a suit, in which another manufacturer joined, on the ground that the complainants' constitutional right to receive gas service at a reasonable rate was violated by the "flat" rate, because it compelled them to pay the cost of serving thousands of "convenience users" and thereby made their payment for gas excessive. The manufacturers demanded that the anti-service-charge law be enjoined and that they be given a form of rate which would free them from the necessity of paying a part of other customers' gas bills. The federal court upheld their contentions and granted them a decree.

JURY IS ENTITLED TO DECIDE ON DEGREE OF CARE EXERCISED BY COMPANY.—A directed verdict for the defendant company in Reynolds vs. Iowa Southern Utilities Company has been overthrown and a new trial ordered by the United States Circuit Court of Appeals. In this case a boy was injured while playing in a tree through which one of the defendant's wires passed. The trial judge sustained a motion to direct a verdict for the company on the grounds that the boy was guilty of contributory negligence, that nothing constituted an invitation to him to approach the wires or put himself in danger, that no knowledge on the part of the defendant of the unsafe condition of the electric light pole or tree as to cross bars or steps attached thereto had been shown, and that the evidence failed to show any negligence on the part of defendant which could be construed as a proximate cause of the injury. The Circuit Court held that these issues had been wrongly taken out of the hands of the jury, whose part it was to say whether the company had exercised the right degree of care in maintaining what was said to be an attractive nuisance.

LINES THAT CROSS NO PUBLIC PLACES MAY COMPETE WITH MUNICIPAL PLANT.—The United States District Court of North Carolina has decided that a private power company may enter the corporate limits of a city and retail electrical energy in competition with the municipally owned and operated power company without a franchise from the city, provided that the power company's lines do not cross streets, alleys or public places owned or controlled by the city. Action brought by the city of Tarboro, N. C., sought to enjoin the Virginia Electric & Power Company from serving cotton mills and other industries within the city limits. The power company had been able to construct its lines into Tarboro entirely over private property and without crossing any streets or alleys. The first lines were built two years ago to serve certain mills. Recently additional mills sought power contracts with the company and to block extensions of its lines an injunction was obtained in the state courts. In its judgment dissolving the enjoining order the federal court ruled that the power company needed no franchise to do business in Tarboro and that it would be a dangerous doctrine to hold that a commodity such as electric power should be withheld from industry and the manufacturer be forced to buy from a municipality whether that service was satisfactory or not.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

News About Men of the Industry

C. N. Stannard New President Rocky Mountain Division

Clare N. Stannard, who was elected president of the Rocky Mountain Division of the National Electric Light Association at the recent convention in Colorado Springs, has been affiliated with the electrical industry in Denver for almost thirty years and at the present time occupies the position of vice-president and general manager of the Public Service Company of Colorado. Mr. Stannard was born in New York State. Although his first connection was with a bank in Binghamton, N. Y.,

C. N. STANNARD

at an early age he became interested in public utility work, entering the employ of the gas and electric company of that city. Street-railway operation then attracted his attention, and after a brief period in the South be removed to Denver, where he obtained a position with the city tramway company.

One year later Mr. Stannard affiliated himself with the Denver Consolidated Electric Company, the forerunner of the Denver Gas & Electric Light Company, which in turn was merged with the Western Light & Power Company to form the Public Service Company of Colorado. During this period he has advanced steadily from a position in the auditing and cashier's department to the office of vice-president and general manager. Mr. Stannard has been active in civic affairs in Denver as well as in public utility association work in that city and in the Rocky Mountain region.

L. J. ROBERTS, superintendent of electric distribution of the People's Light Company, Davenport, Iowa, has been appointed assistant to C. R. Stahl, general manager of the Panhandle Power & Light Company at Borger, Tex. Mr. Roberts affiliated himself with the United Light organization immediately after graduation from the University of Iowa in 1920. Following a year's association with the gas plant of the People's Light Company and a year in electrical distribution work he was made superintendent of electrical distribution, the position he has held for the past five years.

ROBERT P. GILMAN, formerly connected with the Fitchburg (Mass.) Gas & Electric Light Company, has recently been appointed sales manager of the Brattleboro (Vt.) Gas & Electric Light Company.

J. W. BLEASE, who has been in charge of the West Tennessee district for the Tennessee Electric Power Company since its organization in January, 1926, has resigned to affiliate himself with the Broad River Power Company in South Carolina.

L. A. WIEDMAN, formerly manager of the Oklahoma Gas & Electric Company at Poteau, has been appointed manager at Norman to succeed C. C. Stewart, resigned. Mr. Wiedman's affiliation with the Oklahoma Gas & Electric Company dates back to 1919, and during this eight-year period of service he has been connected with the Sapulpa, Oklahoma City, Poteau and Muskogee offices.

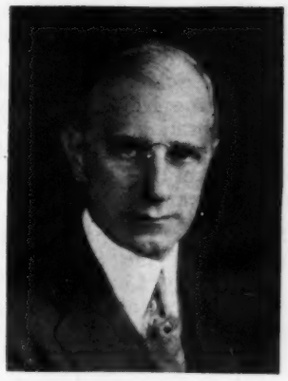
ROMIE W. WILSON, formerly assistant manager and superintendent of construction of the Manchester (N. H.) Traction, Light & Power Company, has been appointed manager of the Manchester division of the Public Service Company of New Hampshire. Mr. Wilson was more recently vice-president and manager of the Grafton County Electric Light & Power Company.

FREDERICK CUTTS, general manager of the New Haven (Conn.) branch of the General Electric Company for the past fifteen years, has been appointed general manager of the United Illuminating Company, Bridgeport, Conn. Mr. Cutts, who is succeeding the late Charles A. Paul, assumed his new duties Nov. 1.

LESLIE W. NIMS, manager of the Idaho Falls division of the Utah Power & Light Company, has been appointed manager at Provo to succeed Carl A. Wolfrom, who has assumed new duties in Salt Lake City. Mr. Nims' first association with the electrical industry was with the Utah Light & Railway Company in Salt Lake City as operator at various plants, his service in this capacity extending from 1904 to 1908. During the next four years he was in Mexico City, where he was employed by the Mexican Light & Power Company. He then returned to Utah and became chief dispatcher for the Utah Light & Railway Company, which later was consolidated with the Utah Power & Light Company. In 1921 he was appointed division superintendent at Idaho Falls, and two years later the position of manager of the Idaho Falls division was given to him.

H. P. Liversidge New President of Edison Association

Horace P. Liversidge, who was recently elected president of the Association of Edison Illuminating Companies, has been an outstanding figure in engineering circles for many years. This position of prominence has been attained by Mr. Liversidge not only because of the enviable record he has made as an executive of one of the country's leading light and power companies—the Philadelphia Electric Company—but also because of his accomplishments in the way of furthering



H. P. LIVERSIDGE

the work of the various national electrical associations.

From his boyhood he was interested in practical engineering and after his graduation from the Norristown (Pa.) High School he studied at Drexel Institute, Philadelphia. Before completing the electrical engineering course at that institution he left to affiliate himself with the Edison Electric Light Company of Philadelphia, which with other independent companies was later consolidated into the Philadelphia Electric Company. Mr. Liversidge has been associated with this company continuously, serving successively as assistant superintendent of operation, assistant superintendent of station design and construction, operating engineer in charge of all plants, assistant chief engineer, vice-president and vice-president and general manager, the position he occupies at the present time.

Mr. Liversidge has given unstintingly of his time and energy to the work of the various engineering societies. In the course of his active career he has held membership on numerous national committees and sub-committees of the A.I.E.E., the N.E.L.A. and the A.S.M.E as well as the association he has just been selected to head.

WILLIAM F. THOMPSON, who has been connected with the People's Light Company at Davenport, Iowa, for some

time, has been appointed superintendent of electric distribution for that organization. Mr. Thompson, an expert in the Schaefer method of resuscitation, won the Insull medal last year for saving the life of a fellow employee.

JOHN F. EGOLF, formerly general manager of the Chicago, North Shore & Milwaukee Railroad, has become operating vice-president of the Western United Gas & Electric Company at Joliet, Ill., with the resumption of direct management of the properties by the corporation's own officers.

W. POOLE DRYER has been appointed a member of the mechanical division of Stone & Webster, Inc., Boston. He formerly engaged in consulting engineering practice and in recent years has been identified with the development of large steam-turbine units by the General Electric Company.

E. K. KARCHER, who has been connected with the Utica (N. Y.) Gas & Electric Company for the past eight years, has been appointed distribution engineer for the New York Power & Light Corporation, Albany. Mr. Karcher has been acting as chief electrical engineer of the Utica company for the past two years.

G. S. NUNEMAKER has resigned as vice-president of the Southern Cities Utilities Company, Chattanooga, Tenn., in order to devote all his time to the interests of Anderson & Company, a financial house of Providence, R. I. The resignation is effective Jan. 1, 1928. Mr. Nunemaker has been affiliated with the electric light and power industry in Tennessee for some time, having formerly been associated with the Tennessee Power Company and with the Cumberland Power Company.

REX I. BROWN, general commercial manager of the Arkansas Power & Light Company, Little Rock, Ark., has been made assistant to C. J. Griffith, vice-president directly in charge of the electric department. Mr. Brown has been affiliated with the electrical industry of Little Rock for the past twenty years, and during that period of time he has seen his company develop from a local central station, the Little Rock Railway & Electric Company, to a major factor in one of the large superpower systems of the country. He will continue as general commercial manager.

ERNEST E. WHITNEY has been appointed resident managing director of the People's Gas & Electric Company, Oswego, N. Y., according to an announcement made by Charles E. Norris, vice-president of F. L. Carlisle & Company, New York, and president of the People's Gas & Electric Company of Oswego. Mr. Whitney will be in charge of all Carlisle properties in Oswego and will act as personal representative of F. L. Carlisle & Company. More than two years ago Mr. Whitney removed to Oswego as general manager of the Oswego River Power Corporation. He is vice-president and general manager of the Oswego Industries Corporation and also a director in the People's Gas & Electric Company and the Oswego Rayon Corporation.

J. R. RAMSEY, formerly assistant to S. J. Magee, vice-president and general manager of the Associated Gas & Electric System, has been appointed general manager of the Depew and Lancaster division of New York State properties, succeeding A. R. Tremaine, now head of all New York properties with the exception of the Long Island and Staten Island group. A graduate of the Massachusetts Institute of Technology, Mr. Ramsey joined the New York & Queens Electric Light & Power Company at Long Island City in 1917 in the capacity of assistant power engineer. Six years later he became identified with the Associated system as power engineer for the New York State Gas & Electric Corporation at Ithaca, subsequently removing to Oneonta and more recently to New York.

Obituary

J. JARVIS PREBLE, vice-president of the Spray Engineering Company, Boston, died Oct. 29. Mr. Preble had been associated with the Spray Engineering Company for fourteen years and for the past two years had occupied the office of vice-president.

WILLIAM A. JACKSON, telephone pioneer and first president and general manager of the Michigan Bell Telephone Company, died Nov. 14 at New York, in his seventy-ninth year. After the Michigan company was sold in 1888 he founded the Detroit Electrical Works, makers of electric railway equipment, and was its president for several years. Subsequently he became a director of the Chicago and Iowa Telephone companies and the Missouri Bell Telephone Company, and later he reassumed the presidency of the Michigan company, from which office he retired in 1913.

ALBERT CHAMPION, Franco-American spark-plug manufacturer, died in Paris, France, Oct. 27. Mr. Champion's death came while he was touring his branch factories in France and England. In 1908 Mr. Champion, with a few associates, started one of the first spark-plug plants in the United States—a small factory at Boston. Three years later with W. C. Durant he organized the present AC Spark Plug Company in Flint, Mich. Mr. Champion was 47 years of age.

GEORGE H. BENJAMIN, industrial engineer and patent expert, died at his home in New York Nov. 10 in his seventy-fifth year. In the course of an active and useful life Mr. Benjamin cultivated a diversity of interests which made him a man of many accomplishments. In addition to being internationally known as a patent expert and industrial engineer, he was noted as a criminologist and had frequently been consulted by Scotland Yard as a technical expert. A graduate of the Albany Medical College, he practiced medicine and surgery early in his career for a period of five or six years. His library, which is famous, is indicative of the literary taste of one who was himself a writer of no mean ability, magazines, newspapers and trade journals having published many contributions from his pen. Mr. Benjamin was frequently retained as patent expert and counselor by several of the large electrical companies.

WILLIAM P. BONBRIGHT, founder and for many years president of the banking house of Bonbright & Company, died Nov. 10 in Roosevelt Hospital, New York. A native of Philadelphia, Mr. Bonbright entered upon his career with Hood, Bonbright & Company of that city in 1876, six years later being admitted to partnership. It was in 1920 that he retired from the presidency of Bonbright & Company, New York. This company under the leadership of Mr. Bonbright rapidly forged to the front of investment banking firms and was a pioneer in light and power securities. It has co-operated closely with the electrical industry during its development and has made notable contributions to its progress through the Bonbright survey and the Bonbright prize awards. Mr. Bonbright had many friends among utility executives and has always been an enthusiastic advocate of the utility industry. Mr. Bonbright was 68 years of age.

JAMES COX BRADY, prominent financier, industrialist and philanthropist of New York, died of pneumonia Nov. 10 at his home in that city after a week's illness. Mr. Brady was a son of the late Anthony N. Brady, one of the principal organizers of the old Brooklyn Rapid Transit Corporation, and a brother of Nicholas F. Brady, president of the New York Edison Company. James Cox was the financial man for the Brady interests, while Nicholas F. Brady assumed responsibility for the executive work connected with the organization and merging of public utility properties. Included in these were such enterprises as the Consolidated Gas Company of New York, New York Edison Company, Brooklyn Edison Company, Cohoes Power & Light Company, Utica Gas & Electric Company and the Dayton (Ohio) Power & Light Company. At the time of his death Mr. Brady was first vice-president and a director of the Brooklyn Edison Company and a director of the Mohawk-Hudson Power Corporation and of other industrial organizations. He was 45 years of age.

Financial and Statistical News

Flood Area Stocks Firm Company Damage Limited Wider Fluctuations

INFORMATION from the New England flood area indicating that damage to utility properties is comparatively small has had a salutary effect on stocks of companies operating in that area. The New England Power Association, whose system is widely spread over the districts affected, is reported to have suffered no permanent damage to generating plants or dams. This seems to be the experience also of the other large groups, although damage to individual properties in some instances was heavy. The whole situation provides a fresh example of the benefits of interconnection and diversified holdings on the part of the large holding-company groups.

Utility stocks have ridden up and down recently in response to market gyrations more than is usually the case. This is a natural consequence of increased public and pool interest in these issues. Investment funds are diverted extensively to these stocks from the more speculative industrial and other issues when market uncertainty such as that of the last few weeks exists.

On the average, power and light common stocks have gained ground during the week. Some examples of higher quotations for the week are American Gas & Electric, Middle West Utilities, Pacific Gas & Electric, Philadelphia Electric and Southeastern Power & Light. Preferred issues have receded slightly, if anything, although there are few price changes of importance. Standard Gas & Electric and Electric Bond & Share preferred issues made slight advances. Bond prices remain firm with little change in averages recorded.

Fifteen Leading Electrical Systems of Canada

A recent study of electric power systems in Canada for the calendar year 1926 shows that the Dominion now possesses fifteen systems each having an output reaching approximately 100,000,000 kw.-hr. or more per annum. The total output of these fifteen systems, excluding duplication, represents about 82 per cent of the total output of the public utility or central-station systems of Canada.

The systems referred to in order of their total output during the year 1926 are: (1) Hydro-Electric Power Commission of Ontario; (2) Shawinigan Water & Power Company, Quebec; (3) Montreal Light, Heat & Power Consolidated, Quebec; (4) Canadian Niagara Power Company; (5) Laurentide Power Company, Quebec; (6) West Kootenay Power Company, British Columbia; (7) British Columbia Electric Railway Company; (8) City of Winnipeg Hydro-Electric System, Manitoba; (9) Winnipeg Electric Company; (10) Canada Northern Power Corporation, Ontario and Quebec; (11) Dominion Power & Transmission Company, Ontario; (12) Ottawa & Hull Power & Transmission Company, Quebec; (13) Duke-Price Power Company, Quebec; (14) Kaministiquia Power Company, Ontario; (15) Southern Canada Power Company, Quebec.

The annual output of several of these systems is a large multiple of a hundred million kilowatt-hours per annum, and the first four far exceed a billion kilowatt-hours each. The total output for 1926, excluding duplication due to purchased power, was nearly 10,000,000,000 kw.-hr.; the total installed plant was over 3,300,000 hp., of which 96 per cent was water power, and the mean load factor was 60 per cent.

COMMONWEALTH EDISON DIRECTORS VOTE STOCK INCREASE.—Directors of the Commonwealth Edison Company of Chicago recently voted to apply to the Illinois Commerce Commission for authority to issue additional capital stock to the extent of 12½ per cent of the outstanding stock. If the issue is authorized, the stock will be offered at par to stockholders for subscription early next year. With the stock outstanding at the present time amounting to $110,592,400, an increase of 12½ per cent will mean an additional issue of $13,824,050.

Investor Deserves a Square Deal*

Some Utility Companies Display Absurd Shortsightedness in Overlooking the Rightful Demands of Purchasers of Securities

BY JOHN W. STEDMAN
Vice-President Prudential Insurance Company of America

LET me speak of a matter which indicates the subservient attitude of some distributors to the corporation having the securities for sale. The drafting of mortgage indentures containing the provision that a specified percentage, usually from 80 to 90, of the bondholders may alter or modify in any or in certain important particulars the rights of the bondholders and the obligations of the company is most objectionable to the investor. Put yourselves in the place of the officers and directors of a large fiduciary institution who morally serve as trustees for the savings of millions of people. Would you buy a long-term mortgage bond the principal or rate of interest of which might, without your consent, be cut in half, or the maturity of which might be extended twenty years, or the lien of which might be subordinated to the lien of a new mortgage or released entirely?

On first thought you might retort, "What of it? Those things happen all the time in reorganization." That is only partly true, because before reorganization plans are consummated the bondholders who are dissatisfied may withdraw from the protective committee under which they deposited and either submit their case for adjudication or accept their distributive share of cash realized by foreclosure sale. Such provisions, known as "modification clauses," are objectionable, owing to the fact that they make the buyer a party to what is called in legal parlance an "inchoate or incipient reorganization." He is pledged upon purchase to abide by the decision of others perhaps years hence. He has put himself out of court and has deprived himself forever of seeking legal remedies for inequitable treatment. Please understand me as holding no brief for aiding the selfish minority dissenter to realize par and interest when others, to prevent shipwreck, have taken their loss by jettisoning a large part of the cargo. I fully appreciate that a clause binding 10 to 20 per cent of the bondholders by the action of the rest will eliminate the blackmailing obstructionist, but I do not agree with some bankers and their counsel that the interest of the borrowing corporation is paramount even to the exclusion of the right of the investor to obtain a ruling of the court.

Lest I seem to talk only in legal generalities, I am going to be so rash as to construct a hypothetical case. Let us suppose that the Excelsior Edison Company, serving a growing industrial and residential community but possessing inadequate and somewhat antiquated generating capacity, is consolidated with the Progressive Power & Light Company, serving a neighboring town with fewer industries but having a modern and expandable power plant. The new company, which in consolidation is overcapitalized, has outstanding, let us suppose, $6,000,000 common stock, $5,000,000 Excelsior Edison first 5's, secured by first mortgage on the property of the former company, and $7,000,000 Progressive Power & Light first and

*From an address delivered at the sixteenth convention of the Investment Bankers' Association of America at Seattle.

refunding 5½'s, secured by first mortgage on the property of the latter company and by second mortgage on the property of the former company, these bonds having been issued to retire $3,000,000 underlying bonds of the old company, to build a transmission line to interconnect the two properties, to enlarge the power plant of the old Progressive Power & Light Company and "for other corporate purposes"—that hackneyed, high-sounding phrase that tells the investor nothing.

Industrial depression, corrupt and sleepy management, local animosity and political attack, after a few years, finally result in receivership. The receiver, to conserve cash resources, induces the court to order default in the payment of all interest. In consequence, during the next year the bonds of both issues drift downward in price till they are quoted in a tight money market at 40 cents on the dollar. Protective committees are formed for each issue, and while the holders of Excelsior Edison first 5's, disheartened by the shutdown of so many industries, lack the courage and vision to buy in their property at foreclosure and raise new capital to rehabilitate their old steam station, the holders of Progressive Power & Light first and refunding 5½'s, fearful of the outcome, pursue a policy of watchful waiting.

Strong outside public utility interests see, in surveying the situation, the future possibilities of profit following a reorganization of the capital structure to be gained from efficient and popular management, but lose their enthusiasm to acquire control upon finding that the common stock is closely held and unobtainable at a bargain figure. At this juncture it is discovered that the indenture under which the Excelsior Edison Company first 5's were issued contains a clause that 80 per cent of the bondholders may modify the terms of the bond with respect to principal, interest, maturity and lien. These interests, after quietly picking up $1,000,000 bonds in the 40's, make an offer to the protective committee of $500 per bond for the $3,000,000 of bonds deposited, which, in despair of anything better, is accepted. Then, as holders of 80 per cent of the issue, they arrange to vote to convert the entire issue into new common stock, if and when the Progressive Power & Light Company bondholders foreclose their mortgage, thereby wiping out the old stock, and if and when the Progressive bondholders agree to take in exchange 75 per cent of a new issue of 5½ per cent bonds, to be secured by first mortgage on the entire consolidated property. As a refusal of this proposition would bring retaliation from the new interests, who would take over the Excelsior property by foreclosure, the large majority of the Progressive Power & Light bondholders give their assent. The new interests are then in the saddle, owning $4,000,000 of the $5,000,000 of new stock, for which they paid less than $2,000,000, and can afford to wait till the property is thoroughly rehabilitated and the company firmly on its feet before declaring an initial dividend. But, I ask you, what about the holders of $1,000,000 of Excelsior company first 5's, who were forced, willy-nilly, to take common stock when if their hands had not been tied they would have received in any equitable reorganization ordered by the court at least 50 per cent in the new first mortgage bonds and 50 per cent in new preferred stock? Would not the financial officers and directors of a large fiduciary institution be justly criticised for allowing their company to be caught in a similar position? The large security owner must of necessity co-operate

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Nov. 15	Low 1927	High 1927
ABITIBI PWR. & PAPER, 4% com.—no par	132½	83	141½
Adirondack Pwr. & Lt.—7% pf.	111	107	113½
Adirondack Pwr. & Lt.—8% pf.	115	112	116
Ala. Pwr., $7 cum. pf.—no par	114	107½	114
Allis-Chalmers Mfg., 7% pf.	m111½	109	112½
Allis-Chalmers Mfg., 6% com.	113	88	118½
Aluminum Co. of Amer., com.	97	67½	105½
Aluminum Co. of Amer., 6% pf.	104½	101½	104½
Amer. & Foreign Pwr., pf. 25% pd.	m110	....	....
Amer. & Foreign Pwr., 7% pf.—no par	104½	86½	108
Amer. & Foreign Pwr., com.—no par	28½	18½	30½
Amer. Bosch Magneto, com.—no par	24½	13	26½
Amer. Brown Boveri Elec†	9½	5½	39½
Amer. Brown Boveri Elec., pf. $7	45	40	98
Amer. Gas & Elec., 6% pf.—no par	105	95½	105
Amer. Gas & Elec., com.†—no par	116½	68½	117½
Amer. Lt. & Trac., 6% pf.	112	112	120
Amer. Lt. & Trac., new com.	174	164½	186
Amer. Pwr. & Lt., 6% pf.	107½	97½	107½
Amer. Pwr. & Lt., com.†—no par	67½	54	73½
Amer. Pub. Serv., 7% pf.	a 98½	94	104
Amer. Pub. Serv., com.†	70	65	75
Amer. Pub. Utilities, 7% pfd. pf.	a 88½	73	90
Amer. Pub. Utilities, 7% pr. pf.	a 94½	92	96
Amer. Pub. Utilities, com.	£ 57	65	70
Amer. States Sec., A	5	2½	4½
Amer. States Sec., B	4½	2½	4½
Amer. Superpwr., 6% pfd. pf.—25	£ 29	26½	29½
Amer. Superpwr., 6% 1st pf.	f 98½	....	....
Amer. Superpwr., Class A†—no par	38½	27½	41½
Amer. Superpwr., Class B†—no par	39½	28½	43
Amer. Wtr. Wks. & Elec., 6% pf.	£100½	99½	100½
Amer. W. W. & E., com. new—no par	62½	46	72½
Anaconda Copper cap. $3	49½	41½	49½
Appalachian Electric Pwr., 7% pf.	106½	100	105
Arizona Pwr., 7% pf.	£ 85	77	88
Arizona Pwr., com.	m 20	....	....
Arkansas Pwr., & Lt. 7% pf.	106	....	....
Assoc. Gas & Elec., $3.50—50	51½	....	....
Assoc. Gas & Elec., pf.—$6—no par.	93	85	96
Assoc. G. & E., Class A, 10—no par.	44½	35	44½
BABCOCK & WILCOX, 7% com.	116	113	124
Binghamton L., H. & P., $6 pf.	98	93	102
Birmingham Elec., pf.—$7—no par.	109½	105	110
Blackstone Valley G. & E., 6% pf.	107½	103	105
Blackstone Valley Gas & Elec., 10% com.—50	128	98	153
Blaw-Knox, com.†	m 95	70	96½
Brazilian Trac., Lt. & pwr., com.†	f204	....	....
Broad River Pwr., 7% pf.	103	97	104½
Brooklyn Edison, 8% com.	178	148½	184½
Buffalo, Niagara & East. Pwr., $1.60 pf.—25	f 26½	....	....
Buffalo, Niagara & East. Pwr. com. $1—no par.	f 36½	....	....
CALIFORNIA ELEC. GENERATING, 6% pf.	99	96	99½
California Ry. & Pwr., 7% pf.	135	125	150
Carolina Pwr. & Lt., pf.—$7—no par	f109½	107	109
Central & S.W. Util., $7 pf.—no par	a 98	92½	99
Central & S.W. Util., pr.ln.$7 pf.—no par	a102½	98½	104½
Central Ark. Ry. & Lt., 7% pf.	106	100	104
Central Ill. Pub. Serv., $6 pf.	a 93	88½	95½
Central Ind. Pwr., 7% pf.	a 95	85½	95
Central Pwr. & Lt., 7% pf.	102	100½	103
Central States Elec., 7% pf.	99½	92½	101½
Central States Elec., com.†	m 29½	17½	30½
Century Elec., 6% com.	b135½	114	162
Chicago Fuse Mfg., com.—$2.50 no par	m 31	30	35½
Cincinnati Gas & Elec., 5% com.	g 99½	96½	100½
Cities Service, $6 pf.—no par	f 94½	87	94½
Cities Service, pf. B—no par	f 8½	8	8½
Cities Service, pf. BB—no par	f 87	80½	86
Cities Service, com.—20	f 50½	40½	58½
Cities Service, Bks. Shrs.—10	f 25½	22½	27
Clarion River Pwr., 8% pf.	95	....	....
Cleveland Elec. Illg., 6% pf.	110	108	112
Cleveland Elec. Illg., 10% com.	330	285	340
Columbia Gas & Elec., 6% pf.	108	99½	108
Columbia G. & E. com. $5—no par	89½	82½	95½
Columbia Ry., Gas & Elec., 6% pf.	m 98	97	100
Columbus Elec. & Pwr., $2 com.—no par	64	....	....
Columbus Ry., Pwr. & Lt., 6% 1st pf.	104	98½	106
Columbus Ry., Pwr. & Lt., 6½% pf. B	103	96	104
Columbus Ry., P. & L., com.—no par	100	75	105
Commonwealth Edison, 8% com.	a166	138	171
Commonwealth Pwr., 6% pf.	101½	91½	103½
Commonw'th Pwr., $2, com.—no par	67½	48½	78½
Conn. Lt. & Pwr., 8% pf.	121	119	123
Conn. Lt. & Pwr., 7% pf.	117	112	118
Cons. Gas of N. Y., pf.	100½	93	100½
Cons. Gas of N. Y., com $5—no par.	115½	94	121½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf.	£105	105	107
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	e113	110½	114½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf.	e114½	112½	117
Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf.	e129	127	130½
Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par.	e 68	51	71
Consolidated Pwr. & Lt., 7% pf.	105	100	106
Consumers Pwr., 6% pf.	104	100	102
Consumers Pwr., 6.6% pf.	106	103	105½
Continental Gas & Elec., 8% pfd. pf.	108	103	106½
Continental Gas & Elec., 7% pr. pf.	104	100	103
Conti. G. & E. com. $4.40—no par.	£250	210	225
Crocker Wheeler, com.†	25	23	38
Crocker Wheeler, 7% pf.	80	78	88
DALLAS PWR. & LT., 7% pf.	109	107	110½
Dayton Pwr. & Lt., 6% pf.	108	101	109
Detroit Edison, 8% com.	157½	133½	160½
Dubilier Condenser, com.—no par	3	2½	5½
Duquesne Lt., 7% pf.	£117	114½	117
EASTERN NEW YORK UTIL., $7 pf.	107	102	104½
Eastern New York Util. com.	65	70	75
Eastern States Pwr., $7, com.	13	9	14
Eastern States Pwr., pf.	96	90	95
East. Tex. Elec., 7% pf.	106	106	108
Edison Elec. of Boston, $12 com.	d250	217	267
El Paso Elec., 7% pf.	108	105	107½
Elec. Bond & Share, 6% pf.	hC9	105½	110½
Elec. Bd. & Sh. Sec., com. $1—no par	f 76	67½	80½
Electric Household Util.†	a 13	11	15½
Elec. Investors, 6% pf.—no par.	98½	92	97
Elec. Investors, com.†—no par.	42	32½	42½
Elec. Investors, 10% pd. receipts	m 15	....	....
Elec. Pwr. & Lt., ctfs. pf.	£ 106½	96	106½
Elec. Pwr. & Lt., ctfs., 40% pd.	£ 118½	103½	119
Elec. Pwr. & Lt., ctfs, full pd.	m114	108½	111½
Elec. Pwr. & Lt., ctfs., com.—no par.	27½	16½	29½
Elec. Refrig. cap.†	9½	5½	37½
Elec. Ry. Securities, com.—no par.	6	....	....
Elec. St. Battery com. $5.25—no par	72½	63½	79½
Elmira Wtr., Lt. & R.R., 7% pf.	104½	99	101½
Emerson Elec., pf.	m109	107½	111
Empire Pwr., ptc.†	35	26	39
Engr. Pub. Serv., $7 pf.—no par.	107½	93½	108
Engr. Pub. Serv., com.—no par	37	21½	39½
Eureka Vacuum Cleaner, com. $4—no par.	73½	50	77
FAIRBANKS MORSE, 7% pf.	m109	107½	112
F.-M., com.—$3—no par.	33½	30½	43½
Federal Lt. & Trac., com. $1.40	39	37½	47
Federal Lt. & Trac., $6 pf.—no par.	99	91½	100
Ft. Worth Pwr. & Lt., 7% pf.	h111½	108	112
GALVESTON-HOUSTON ELEC. 6% pf.	70	68	72
Galveston-Houston Elec., com.	35	26	32
Gen. Elec., $3 com.—no par.	133½	81	146½
Gen. Elec., special—6%	11½	11	11½
Gen. Gas & Elec. (Del.) com. A. $1.50—no par	37	34	47½
Gen. G. & E. (Del.) com. B—no par.	m 45	35½	44
Gen. G. & E. (Del.) pf. A. $8—no par.	121	113½	121
Gen. G. & E. (Del.) pf. A $7—no par.	£109½	100	110½
Gen G. & E. (Del.) pf. B $7	104	96	105
Gen. Pub. Serv., $7 cum. pf., no par.	£110	102	106
Gen. Pub. Serv., com., no par.	15½	11½	18
Ga. Lt., Pwr. & Rys., 6% pf.	95	87	98
Ga. Lt., Pwr. & Rys., com.	m 50	50	80
Ga. Ry. & Pwr., 8% pf.	k125	119	125
Ga. Ry. & Pwr., 7% pf.	k113½	106	110
Gt. Western Pwr., 7% pf.	h104	..	..
IDAHO PWR., 7% pf.	108½	103	109
Ill. No. Utilities, 6% pf.	£ 96	88	97
Ill. Pwr. & Lt., 7% pf.	102	99	101½
Ingersoll Rand com. $8	87	86½	96½
Int. Combus. Engr., com. $2—no par	50½	40½	64
Int. Util., Class A—$3.50—no par.	£46½	28	47½
Int. Utilities, Class B—no par.	9	3	9½
Interstate Pwr., pf.—$7—no par.	96½	93	98
Interstate Pub. Serv., 7% pf.	100½	98	99½
Iowa Ry. & Lt., 7% pf.	£ 98	97	99
JERSEY CENTRAL PWR. & LT. CO., 7% pf.	104½	97½	105
Johns-Manville, com.†—no par.	118½	55½	123

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, Nov. 12. lBid price Wednesday, Nov. 16. mLatest quotations available. †Dividend rate variable.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Nov. 15	Low 1927	High 1927
KANSAS CITY PWR. & LT. pf.$7	116	112	116
Kansas Gas & Elec., 7% pf.	f107½	103	107½
Kentucky Hydro-Elec., 7% pf.	a103½	94½	103½
Kentucky Sec.,6% pf.	86	83	87
Kentucky Sec., 5% com.	115	110	115
Kentucky Utilities, 6% pf.	100	95	101
Keystone Pwr. & Lt., pf.	m98	95	100
LACLEDE GAS LT., 12% com.	k215	173½	267½
Lehigh Pwr. Sec., com.—no par.	21½	15	22
Long Island Ltg., 7% pf.	110½	107	112
Long Island Ltg., com.†—no par.	168	139	180
Los Angeles Gas & Elec., 6% pf.	103	98	104½
Louisville Gas & Elec., cl. A. $1.75	26½	23½	27½
MAN. ELEC. SUPPLY, cap. $5 —no par.	48	43	132
Manila Elec., com.†—no par.	k 46½	40	60
Maytag Mfg., com. .50—no par.	30½	23½	34½
Memphis P. & L., pf.—$7—no par	109½	107	109
Metropolitan Ed., pf.—$6—no par.	102½	93	100
Metropolitan Ed., pf.—$7—no par.	109	104	108
Metropolitan Ed., com. $5—no par.	70	60	72
Middle West Utilities, 7% pf.	a117½	110½	118½
Middle West Util., 8% pr. lien	a126½	117½	127
Middle West Util., com. $6—no par	a116½	108	117½
Midland Utilities, pr. in. 7% pf.	a105	97½	107½
Midland Utilities, 7% pf. A	a100½	96½	103½
Milwaukee Elec. Ry. & Lt., 7% pf.	k102	100	103
Milwaukee Elec. Ry. & Lt., 6% pf.	k 98½	98	101½
Minn. Pwr. & Lt., 7% pf.	f107½	104	107
Miss. Pwr. & Lt., $8 pf.	m101	106	103
Miss. River Pwr., 6% pf.	104	94	104½
Miss. River Pwr. 3% com.	62	....	....
Mohawk Hudson Pwr., 1st pf.—$7 —no par.	106½	101½	112
Mohawk Hudson Pwr., 2d pf.—$7 —no par.	112	98	112
Mohawk Hudson Pwr., com.—no par	29½	20½	32½
Montana Pwr., 5% com.	104½	81½	109½
Montreal Pwr., 7% com.	f 90½	....	....
Mountain States Pwr., 7% pf.	100	97	101
Mountain States pwr., com.†	18	....	....
NASSAU & SUFFOLK LTG., 7% pf.	107	98	110
National Carbon, 8% pf.	a135½	130½	139½
National Elec. Pwr., A†	a 27½	22	28½
National Lt., Ht. & Pwr., com.	24	....	....
National, Light, Ht. & Pwr., 6% pf.	70	....	....
National Pwr. & Lt., pf.—$7—no par	109½	101	110
National Pwr. & Lt., com.†—no par.	23½	19½	26½
National Pub. Serv., 7% pf.	100½	93	100
National Pub. Serv., 7% pfc., pf.	114	108	115
National Pub. Serv., A com. $1.60— no par.	22½	18½	24
National Pub. Serv., B com.—no par	24	14	24
Nebraska Pwr., 7% pf.	f110	106	109½
Nevada-Calif. Elec., com.	k 26	22	27
New Brunswick Pwr., 4% pf.	60	....	....
New Eng. Pub. Serv., pr. in. pf. $7..	101	98½	102
New Eng. Pub. Serv., pf. $7	98	95	99
New Orleans Pub. Serv.—7% pf.	106	103	105½
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	90	91	97
N. Y. Central Elec., 7% pf.	102½	101	104
Newport News & Hampton Ry., Gas & Elec., 5% com.	109	....	....
Newport News & Hampton Ry., Gas & Elec., 7% pf.	109	....	....
Niagara Falls Pwr., 7% pf.—25.	29½	27½	29½
Niagara, Lock. & Ont. Pwr., 7% pf.	111	110½	113
No. Amer., 6% pf.—50.	54½	50	55
No. Amer., com.—10	59½	45½	64½
No. Caro. Pub. Serv., pf.—$7—no par	102	93	102½
Northeastern Pwr., com.	22½	14½	25
No. N. Y. Utilities, 7% pf.	105½	103	109
No. Ohio Pwr., com.—no par.	16½	9½	18½
No. Ohio Trac. & Lt., 6% pf.	86½	78	81
No. Ont. Lt. & Pwr., 6% pf.	k 91½	84	95
No. Ont. Lt. & Pwr., 4% com.	72	73	78
No. States Pwr., (Del.) 7% pf.	109½	100½	109½
No. States Pwr., (Del.) 8% com.	129½	109½	133
No. Texas Elec., 6% pf.	k 65	65	70
No. Texas Elec., com.	k 20	27	36
OHIO BRASS, com. B $4—no par.	109½	76	109½
Ohio Brass, 6% pf.	105½	100	107
Ohio Pwr., 6% pf.	103½	96	103
Ohio Pub. Serv., $6 pf.	100	95	96½
Ohio Pub. Serv., 7% pf.	109½	103	109
Ohio River Edison, 7% pf.	109	103	109½
Oklahoma Gas & Elec., 7% pf.	104	...	....
PACIFIC GAS & ELEC., 6% pf.	26½	24½	26½
Pacific Gas & Elec., 8% new com.	45½	21	45½
Pacific Pwr. & Lt., 7% pf.	f105	102	104½
Penn Cent. Lt. & Pwr., $5 pf.—no par	c 79	75½	80
Penn-Ohio Edison, 7% pf.	105½	97½	109½
Penn-Ohio Elec., 7% pf.	m102	99	103
Penn-Ohio Pwr. & Lt., 7% pf.	109	99	110
Penn Pwr.& Lt.—$7—no par.	f109½	107	109
Penn Wtr. & Pwr., 8% com., new.	c 67	....	....
Phila. Co., 6% pf.—50.	c 52½	49½	54
Phila. Co., com.—50.	130	85½	132½
Phila. Elec., 8% com.—25.	c 55½	46½	58½
Portland Elec. Pwr., 7% pf.	100	97½	102½
Portland Elec. Pwr., 6% pf.	75	78	84
Portland Elec. Pwr., 6% 2d pf.	65	55	70
Portland Elec. Pwr., com.	30	22	30
Potomac Elec. Pwr., 6% pf.	f111½	....	....
Pwr. Corp. of N. Y., com. $1—no par	m 79	....	....
Pwr. Sec., pf.—no par.	k 56	40	56
Pwr. Sec., com.—no par.	12½	6	12½
Public Serv. of Colorado, 7% pf.	f104	99	103
Pub. Serv. of N. J., 6% pf.	k104	98½	104
Pub. Serv. of N. J., 8% pf.	k135½	125	135½
P. S. of N. J., $2 com.—no par.	42½	32	46½
Pub. Serv. of No. Ill., 6% pf.	a109½	101½	109½
Pub. Serv. of No. Ill., 7% pf.	a119	112½	119
P. S. of No. Ill., com. $8—no par.	a156	140½	161½
Pub. Serv. of No. Ill., $8 com.	a156	132	161½
Pub. Serv. of Okla., 7% pr. in.	101½	90	103
Pub. Serv. Elec. & Gas, 6% pf.	k108½	102	108½
Puget Sound Pwr. & Lt., 7% pr. pf.	109½	103½	111
Puget Sound Pwr. & Lt., $6 pf.— no par.	89	....	....
Puget Sound Pwr. & Lt., com.	34	29½	36
RADIO CORP. OF AMER., $3.50 pf.—50.	55½	49	56½
Radio Corp. of Amer., com.—no par.	83½	41½	83½
Republic Ry. & Lt., pf.	m120	....	....
Republic Ry. & Lt., com.	m135	112	135
Rochester Gas & Elec. 6% pf. D.	105	101	103½
Rochester Gas & Elec., 7% pf. B.	104½	105	107
Rochester Gas & Elec., 6% pf. C.	104½	101½	103½
SAFETY CABLE, com. $4.	59½	52½	74½
San Joaquin Lt. & Pwr., 7% pr. pf.	111	105	112½
St. Joseph Ry., L., H. & P., 5% pf.	72	70	73
Servel Corp.	12cts	12cts	104½
Sierra Pacific Elec., 2% com.	28½	24½	31½
Sioux City Gas & Elec., 7% pf.	104	99	105½
Southeastern Pwr. & Lt., pf.—$7 no par.	f108½	....	....
Southeastern Pwr.& Lt.,pfc.pf.	f 82½	....	....
Southeastern Pwr. & Lt., com.—no par.	45	29½	45
So. Calif. Edison, 8% pf.	40	36½	40
So. Calif. Edison, 7% pf.	28½	27½	28½
So. Calif. Edison, 6% pf.	25½	24½	27
So. Calif. Edison, 8% com.	39½	31½	41
Southern Cities Utilities, 7% pf.	76	69½	92
Southern Cities Utilities, com. $4.	m 32½	31	42½
Southwestern Lt. & Pwr., A $3.	63	60	65
Southwestern Lt. & Pwr., B.	63	60	65
Southwestern Lt. & Pwr., $6 pf.	88	83	91½
Southwestern Pwr. & Lt., 7% pf.	k112	103	110½
Springfield (Mo.) Ry. & Lt., 7% pf.	k102	95	102
Standard Gas & Elec., 8% pf.	65½	67½	65½
Standard Gas & Elec., 7% pr. pf.	109	103	112
Standard G. & E., com. $3.50—no par.	60½	54	65½
Standard Pwr. & Lt., 7% pf.	102½	98½	102½
Staten Island Edison, pf.—$6—no par.	100	99	101
Superheater, $6 com.—no par.	170	170	185
Syracuse Lighting, 7% pf.	110	103	107
Syracuse Lighting, 8% pf.	117½	....	....
Syracuse Lighting, 8% com.—no par	m300	....	....
TAMPA ELEC., com. $2.	63	49	64½
Tenn. Elec. Pwr., 6% pf.	100	92	100
Tenn. Elec. Pwr., 7% pf.	108	103	109
Terre Haute, Ind. & East. Trac., 5% pf.	26	20	30
Terre Haute, Ind. & East. Trac., com	1	1	3
Tex. Pwr. & Lt., 7% pf.	f112½	106	112
Tide Water Pwr., 8% pf.	109	105	110
Timken Roller Bear., com.—$4 no par.	118½	78	142½
Toledo Edison, 8% pf.	m114	115	118
Toledo Edison, 7% pf.	f109½	102	107
Toledo Edison, 6% pf.	k100	95	97
Toledo Edison, 6% com.	100	....	....
Tri-City Ry. & Lt., 6% pf.	96½	96	99
UNITED GAS & ELEC., 6% pf.	101	98	102
United Gas & Elec., com.—no par.	m 57	....	....
United Gas & Elec. (N. J.) 5% pf.	70	70	73
United Gas Impr., 8% com.—50.	c 112½	89½	118½
United Lt. & Pwr., pf.—$4—no par.	k 53	49	55
United Lt. & Pwr., pf.—$6.50—no par.	93½	87	97½
United L. & P., com. A .48—no par.	14½	12½	15½
United L. & P., com. B .48—no par.	k 19	14	20
Utah Pwr. & Lt., 7% pf.	f108½	104	108½
Utica Gas & Elec., 7% pf.	105	105	106½
Utica Gas & Elec., 8% com.	200	....	....
Utilities Pwr. & Lt., 7% pf.	97	93	100
Utilities Pwr. & Lt., com. A $2.	30½	27	34
Utilities Pwr. & Lt., com. B $1—no par.	21½	13½	23½
VERMONT HYDRO-ELEC., 7% pf.	95	95	100
Virginia Elec. & Pwr., 7% pf.	108	105	110
Virginian Pwr., 7% pf.	m108	....	....
Virginian Pwr., com.	75	....	....
WAGNER ELEC., 7% pf.	b 87	68	90
Wagner Elec., com.—no par.	b 32	18½	39½
Washington Ry. & Elec., 5% com.	f425	....	....
Washington Ry.& Elec.,5% pf.	f100	....	....
Washington Wtr. Pwr., 8% com.	167	136	182
West Penn Elec., 7% pf.	109½	102	112½
West Penn Elec., Cl. A $7.	k107½	97½	111
West Penn Pwr., 7% pf.	115½	111	118
West Penn Pwr., 6% pf.	m107½	100½	108½
West Virginia Lt., Ht. & Pwr., 7% pf.	95	94	100
West Va. Utilities, 7% pf.—50.	m 90	48	51½
Western Pwr., 7% pf.	102½	98	103½
Western States Gas & Elec., 7% pf.	103	96	105
Western States Gas & Elec., com.	37	....	....
Westinghouse Elec. & Mfg., 8% com. —50.	84½	67½	89½
Weston Elec. Instrument, Cl. A $2 —no par.	k 31½	30	34½
Weston Elec. Instrument, com.—no par.	k 13½	11	18½
Wheeling Elec., 6% pf.	103	95	104
Worthington Pump, 7% pf. A.	k 40	46	61½
Worthington Pump, 6% B.	37½	37	54½
Worthington Pump, com.	26½	20½	46
YALE & TOWNE com. $5—25.	77	70½	84½

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, Nov. 12. *l*Bid price Wednesday, Nov. 16. *m*Latest quotations available. †Dividend rate variable.

in times of trouble, but, by the same token, he has the influence and must be free to exert it to thwart junior incumbrancers or stockholders from benefiting at his expense.

New Preferred Stock Issues Offered

During the week ended Nov. 17 the Electric Bond & Share Company made an offering of 6 per cent cumulative preferred stock at $109 per share and accrued dividends from Nov. 1, 1927, to yield 5.50 per cent, a piece of financing involving a total of $10,000,000. The sale of this issue will bring the authorized and outstanding 6 per cent preferred stock of the company to $50,000,000. Proceeds will be used in expanding the business of the company and for other corporate purposes.

The American Commonwealths Power Corporation issued 15,000 shares of first preferred stock, seven-dollar cumulative dividend, series A, at 96 and accrued dividends, to yield over 7.25 per cent. The proceeds of the larger part of this issue will be applied in payment of a portion of the cost of the capital stock of the Union Gas Utilities, Inc., the balance having been issued in exchange for $400,000 principal amount of 6 per cent gold debentures, series A.

NEW YORK UTILITY INCREASES CAPITAL.—Paul Smith's Electric Light & Power & Railroad Company, Inc., Saranac Lake, N. Y., has filed a certificate in the office of the Secretary of State increasing its capital stock from 5,000 to 20,000 shares of $100 par value.

CONSOLIDATED DIVIDEND MORE. — Directors of the Consolidated Gas, Electric Light & Power Company of Baltimore voted to increase the quarterly dividend on the no-par common to 75 cents a share. This places the stock on a $3 annual dividend basis instead of $2.50.

WISCONSIN - MICHIGAN COMPANY ISSUES PREFERRED SHARES. — Six per cent cumulative preferred stock of the Wisconsin-Michigan Power Company numbering 12,750 shares, has been offered locally at $100 a share, par value. Payment may be made in cash at time of purchase or in monthly installments of $10 per share.

CUSTOMER STOCK CAMPAIGN.—It is understood that the Gatineau Power Company and the Dominion Power & Transmission Company will announce a customer-ownership campaign early in the year. The latter company about a year ago conducted its first customer campaign with highly gratifying results.

October Industrial Production Over 1926

Metals Group Increases Activities, but Operations Are Still 10 Per Cent Under Those of Last Year—Automobiles Operating Above October, 1926

GENERAL industrial activity during October, as indicated by the consumption of electrical energy by about three thousand large manufacturing plants, was about 1.2 per cent over September and about 0.8 per cent over the activity reported for October, 1926. This is the first time since July that the monthly productive activity has been above that reported for the same month of last year. Conditions in general industry during October, however, were spotty, some industries reporting an increase in activity while others were operating materially under September and last year.

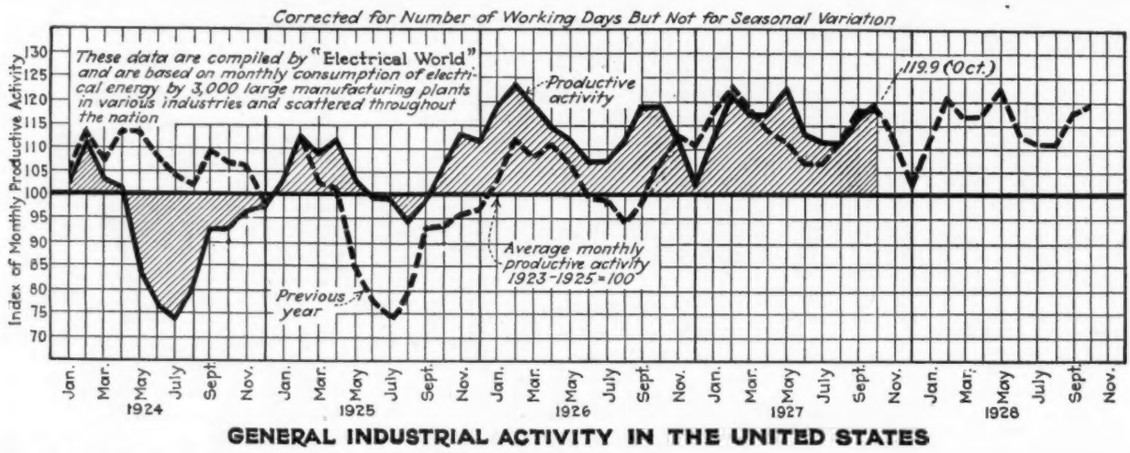
The various sections of the country also reported varying tendencies. The Southern States recorded an increase in activities of 14.3 per cent and the Western States one of 3.6 per cent. On the other hand, New England general productive activities during October were 4.2 per cent under those of last year, the largest twelve-month decrease recorded since December, 1924. Manufacturing plants of the North Central States were operating at a rate 3.4 per cent under October, 1926, and activity in the Middle Atlantic States was approximately at the same level as that witnessed in October of last year.

The index of activity in the manufacturing plants of the nation based on consumption of electrical energy stands at 119.9 for October as compared with 118.4 for September, after adjustments are made for the number of working days in the two months. Comparative indexes of productive activity referred to the average activity for the period 1923-1925 as 100, and adjusted for number of working days, are shown in the following table:

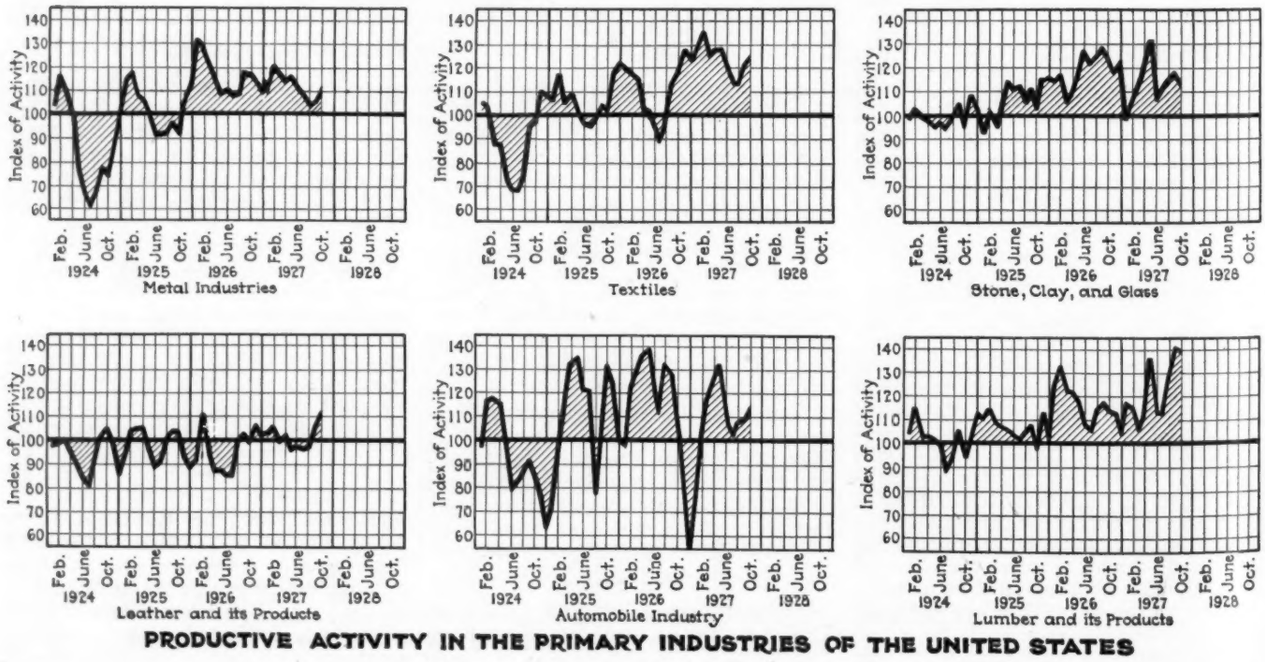
October, 1927	119.9
September, 1927	118.4
August, 1927	110.6
October, 1926	119.0
October, 1925	107.3
Average for 1st six months of 1927	116.8
Average for full year 1926	113.1

Both branches of the metals group, while increasing their activities over September, were still operating materially under October of last year. The steel plants and rolling mills reported an increased activity of 2.0 per cent over September, but still operated at a rate of 9.2 per cent under October, 1926. The metal-working plants increased their activities during the month by 4.3 per cent, but were still operating at a rate of 10.6 per cent under last year.

The upward trend in the activities of the automotive manufacturing plants which started in August was continued through October, the October activity being 5.5 per cent over October last year. The automobile industry evidently is not destined to experience the drastic drop in activity which was witnessed during the closing months of 1926.


Corrected for Number of Working Days But Not for Seasonal Variation
These data are compiled by "Electrical World" and are based on monthly consumption of electrical energy by 3,000 large manufacturing plants in various industries and scattered throughout the nation
Productive activity
119.9 (Oct.)
Average monthly productive activity 1923-1925=100
Previous year
Index of Monthly Productive Activity
1924
1925
1926
1927
1928

GENERAL INDUSTRIAL ACTIVITY IN THE UNITED STATES



PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE UNITED STATES

Business News and Market Conditions

J. H. McGraw Award

Jobbers' Medal and Purse for 1927 Awarded to O. Fred Rost at Electrical Supply Jobbers' Association Meeting

AT THE winter meeting of the Electrical Supply Jobbers' Association, held at Detroit this week, the jobbers' medal and purse for 1927, given under the James H. McGraw award, was presented to O. Fred Rost. The citation accompanying the presentation was as follows:

O. Fred Rost, president of the Newark Electrical Supply Company, Newark, N. J., has for years been prominent in progressive thought in the field of distribution in the electrical industry and an active member of the Electrical Supply Jobbers' Association. In the course of his committee work he has on several occasions made constructive analytical studies of conditions confronting the jobber that have been of material benefit. More recently he conceived the idea of instituting organized instruction for the jobbers' salesmen in the fundamental problems of the electrical contractor and dealer that more practical assistance may be given to these essential customers in the improvement of their economic position. At the request of the association he developed a correspondence course, enrolled some two thousand salesmen throughout the country, and as a result of the most persistant and constructive effort, entailing an exhaustive amount of personal work, has carried through a gratifying proportion of them to completion of the course.

In recognition of this constructive contribution to the advancement of the jobbing branch of the electrical industry, the judges have awarded to Mr. Rost the jobbers' medal and purse for 1927 given under the James H. McGraw award.

The committee of judges which awarded the medal to Mr. Rost consisted of George E. Cullinan, F. R. Price, H. M. Gansmen and George L. Patterson. The committee of awards consists of W. W. Freeman, H. B. Crouse, W. B. Robertson, L. K. Comstock, F. M. Feiker and Earl Whitehorne. In 1925 the medal and purse were awarded to William R. Herstein and certificates of honorable mention to John L. Buchanan, Robert H. Scott, Sylvester C. Greusel and William A. Requa. The medal was withheld in 1926, but certificates of honorable mention were awarded to Warren I. Bickford, William S. Berry, Harry F. Thomas and Thomas J. Creaghead. No honorable mentions are given this year.

Committee to Study Thin Wall Conduit

The technical sub-committee appointed to study thin wall conduit as a new development under the National Electrical Code procedure, and which will report to the article committee by Dec. 1, is as follows: Alexander Maxwell, chairman, National Electric Light Association; R. E. Argersinger, Stone & Webster, Boston; H. L. Huber, American Telephone & Telegraph Company, New York; W. W. Johnston, Board of Fire Underwriters of Allegheny County, Pittsburgh; L. E. Kern, American Institute of Architects, New York; W. J. Mahan, city electrical inspector, New Haven, Conn.; W. Creighton Peet, New York; W. H. Pierson, Underwriters' Association of Middle Department, Bloomfield, N. J., and George Sheridan, Department of Water Supply, Gas & Electricity, New York.

The article committee will give consideration to this report and in turn report its findings for formal action by the electrical committee at its 1928 meeting, called for Feb. 14 to 17, 1928. The submitting manufacturer and others concerned are expected to make contact, through Chairman Maxwell, with the technical sub-committee for the purpose of submitting oral or written briefs covering the possible recognition of this product in the installation regulations of the National Electrical Code.

Spanish Translation of A.I.E.E. Standards

The Spanish translation of A.I.E.E. Standards No. 33, "Standards for Electrical Measuring Instruments," is now available. This translation, together with others which have been previously issued, has been made by a committee of the A.I.E.E. under the chairmanship of Dr. C. O. Mailloux and is being published by the Bureau of Foreign and Domestic Commerce, Washington, D. C. Copies can be obtained from the Superintendent of Documents, Government Printing Office, Washington, at a cost of 5 cents each. These translations are said to be very helpful in promoting a better understanding between electrical industries in this and the Spanish-speaking countries.

Charging Equipment for Industrial Trucks

At the meeting of the electric industrial truck manufacturers, held in Cleveland last month, standard specifications for battery-charging equipment were adopted. These specifications are the result of the work of a sub-committee for over a year, and although they in no way differ from the best practice at the present time it was felt that a situation was finally clarified concerning which there had been considerable difference of opinion in the past. In addition to the above, preliminary plans for 1928 were approved for the co-operative market development program for these manufacturers which is carried on by the Society for Electrical Development, New York.

N.E.M.A. Issues New Handbooks

A completely revised edition of the "Handbook of Supply Standards" has just been issued by the National Electrical Manufacturers' Association. It is a guidebook on the design, manufacture and installation of electrical supply equipment. The book contains 231 pages, is indexed and illustrated, and contains standards indorsed by 189 manufacturers of the Supply Division on air circuit breakers, attachment plugs, fuses, cut-out bases, knife and inclosed switches, etc. It is priced at $3.50. These standards have been approved by the standards committee, the official body for the control of technical standardization within the association.

"This handbook represents in printed form the experience and knowledge of practical and technical men, who have for years been most vitally concerned with the design, manufacture and installation of electrical supply equipment," says C. A. Bates, chairman of the standards committee and chief engineer of the Bryant Electric Company. The N.E.M.A. has also issued the "Handbook for Power Switchboard and Switching Equipment," a revised publication including instructions for the installation, operation and care of power switchboards, oil circuit breakers, power-switching equipment, standard definitions, power switchboard and switching equipment standards, and A.E.S. safety standard for switchboards, oil circuit breakers and oil switches. The price of the book is $1.

Grounding Policy Adopted by Manufacturers

Disregarding all selfish interests and believing that the safest and most effective service that can be rendered the public in connection with the question of grounding would in the end be in the best interests of the electrical manufacturers, the National Electrical Manufacturers' Association committee on grounding, at its meeting on Nov. 1 recommended the adoption of a grounding policy. R. W. E. Moore, chairman of the committee and also chairman of the casualty and fire prevention committee, to which the grounding committee reports, stated that the recommendation for the adoption of this grounding policy was one of the most constructive and far-reaching actions taken by the N.E.M.A. since its organization.

The policy recommended by the committee is as follows:

1. That all central-station supply circuits be grounded as now required in the National Electrical Code.
2. That, in general, stationary non-current-carrying parts in industrial and domestic locations be grounded.
3. That in industrial plants other than

the office the metal non-current-carrying parts of all portable equipment be grounded. In other locations the metal non-current-carrying parts of portable equipment operating at 150 volts and above (to ground) be grounded. In general, when operating below 150 volts, they need not be grounded.

4. That the use of any current-carrying circuit conductor for the grounding of portable or fixed equipment or devices is undesirable and unsafe.

5. That a separate wire, conduit, armor or other suitable conductor may be used for the grounding conductor.

Market Conditions

WITH the exception of a few scattered larger orders central-station buying of equipment has decreased and manufacturers do not anticipate any major orders before the end of the year. Industrial business is very good and a number of good equipment orders were placed by industrial plants in many sections of the country.

In New England about $500,000 worth of power equipment has been purchased. A 2,000-hp. and two 800-hp. motors were bought by the American Steel & Wire Company of Worcester. Losses in the recent flood have created an active demand for distribution material. Industrial business is advancing in the Eastern district, while central-station buying is on a reduced basis. In the Southeast a number of textile mills are planning additions requiring over $100,000 worth of electrical equipment. A number of small and moderate sized orders are maintaining the activity in that territory. Little change is noted in the Middle West. Utility construction is active and includes a $2,000,000 contract for the superstructure of a large plant. On the Pacific Coast a large transformer order, involving $250,000, was placed by a power company.

Strong Demand for Copper in Metal Market

The continued strength in copper both in the United States and abroad, with good sales at higher prices, is the feature of the metal market. The price for usual Eastern deliveries has advanced from 13⅜ cents to 13½ cents, the last-named quotation having been realized on heavy sales on Tuesday and Wednesday. A good tonnage was also sold in the Middle West at 13⅝ cents on Wednesday, some quotations were made as high as 13⅝ cents delivered in the East. Tube, sheet copper and brass manufacturers have all been actively in the market. It is said that cable manufacturers have been heavy buyers abroad, though they have shown little interest here recently. Most of the copper sold has been for either December or January delivery, consumers buying somewhat further ahead than they have been in the habit of doing recently.

Buying of lead has been neither brisk nor dull and prices have been uniform at 6.25 cents New York at which level a good business was done each day. The American Smelting & Refining Company continues its contract price for the New York market at 6.25 cents.

NEW YORK METAL MARKET PRICES

	Nov. 9, 1927 Cents per Pound	Nov. 16, 1927 Cents per Pound
Copper, electrolytic	13¼	13¼
Lead, Am. S. & R. price	6¼	6¼
Antimony	10¼	10¼
Nickel, ingot	35	35
Zinc spots	5.95	6.025
Tin, Straits	56¼	57¼
Aluminum, 99 per cent	25	26

Base copper price Nov. 16, 1927, 15½ cents.

Textile Plants Are Active in Southeast

Manufacturers report a falling off in orders and inquiries, but a reasonable number of small and moderate size orders sustain the activity in the electrical field in the Southeast. Orders are in immediate prospect for boilers and auxiliary equipment for the large turbine purchased last week by an Alabama central-station company, and negotiations are also under way on a power transformer order in Georgia, which latter equipment will cost approximately $90,000. Central-station purchases are off, both in size and number. Some central-station orders placed called for $6,700 worth of cable, watt-hour meters amounting to $5,000 and transformers and lightning arresters totaling $7,000.

Several textile-mill additions have been recently announced, a mill in North Carolina undertaking construction that will call for $50,000 worth of electrical materials; one in Arkansas, $16,000; one in Alabama, $12,000, and one in Georgia, $12,000. A Georgia textile plant ordered this week motor and power transformer equipment totaling $9,000 for an addition to plant, and orders for $7,000 worth of wiring materials from this same mill are in prospect. A woodworking plant in Georgia has asked for bids on a 300-kw. extraction-type turbine, and this contract will undoubtedly be let in the near future. The Georgia Power Company will undertake the construction of a 44,000-volt transmission line from Griffin, Ga., to Woodbury, a distance of 30 miles, to serve new 2,300-volt distribution and street-lighting systems in the towns of Molena, Zebulon and Concord. New substations will be erected in Molena, Concord, Zebulon and Woodbury, the sizes being 75 kva., 225 kva., 150 kva., and 150 kva. respectively.

Other construction projects are as follows: The Gulf Electric Company, Mobile, Ala., plans the construction of a transmission line from Atmore to Bay Minette, about 20 miles. The River Falls Power Company, River Falls, Ala., plans the construction of a transmission line from Glenwood to Goshen, Ala., with installation of substation at Goshen. The City Council, Miami Beach, Fla., is asking bids until Nov. 30 for 87 ornamental light standards, underground conduits, etc. The Southern Railway System, Washington, D. C., has approved plans for a power plant at its proposed new shop and yard terminal at Macon, Ga.; to cost about $350,000. The Georgia Power & Light Company, Waycross, Ga., plans the construction of a transmission line from Du Pont to Lakeland, about 20 miles, and substation equipment will be installed for commercial service in Lakeland. The Kentucky Utilities Company, Louisville, plans the construction of a transmission line from London to Cumberland, about 8 miles, with a substation at Cumberland to cost about $75,000 complete. The Mississippi Power & Light Company, Jackson, Miss., plans the rebuilding of its entire distributing system of Tchula, Miss., and vicinity, and the Kentucky Oxygen-Hydrogen Company, Louisville, Ky., will install electric power equipment in its proposed chemical plant on Cedar Street, Nashville, Tenn. Plans are being prepared for the construction of a manufacturing and warehouse building for the Shelby Electric Company, Memphis, Tenn., to cost about $40,000.

Industrial Business Advancing in Eastern District

There has been marked improvement in several lines of industry in the East, including the metal-working trades, leather, paper and certain branches of the textile field, and as a consequence there is a better call for motors, conduit, control apparatus and other similar industrial electrical equipment. The general volume of transactions is nearer that of a year ago, and manufacturers express an optimistic opinion of the outlook. Central-station orders continue on a decidedly reduced basis, and it is doubtful if there will be any important commitments until after the turn of the year. Light business for heavy electrical equipment is the general report from all of the leading electrical manufacturers in the New York territory.

Both line equipment and substation apparatus continue quiet, with signs of a little revival in the latter line for smaller-type projects. A sizable contract switchboard award is still pending for the new generating station of the New York Edison Company on East Fourteenth Street. That company is also proceeding with a four-story substation on West Thirty-fifth Street, to cost about $125,000, for which a number of equipment commitments have been made. One of the bright spots in the specialty trade is insulating material. One manufacturer reports a gain of more than 200 per cent during the present year, as compared with 1926 trade.

An improved demand for motors and

affiliated industrial equipment is shown in the Philadelphia district owing to the maturing expansion programs of several important local manufacturing interests. The condition, however, is rather spotty and it is held that the movement is of temporary character. Central-station demand remains unchanged, with more brightening aspects in connection with transformers for substation service, power conduits and similar equipment for this character of work. The market for electric refrigerators is good, and the call for appliances shows considerable betterment, owing to the approaching holiday trade.

Forthcoming construction operations in the Eastern district include the following: The Eastern New Jersey Power Company, Asbury Park, N. J., plans a storage and distributing plant at Allenhurst to cost approximately $100,000; the Chamber of Commerce, Salem, N. J., is projecting plans for ornamental standards for the approaches of the new Penn's Neck bridge; the Pennsylvania Edison Company, Easton, Pa., is considering the erection of a new service and office building at East Stroudsburg, Pa., to cost about $45,000; the Hygeia Ice Company, Uniontown, Pa., plans the rebuilding of the portion of its ice-manufacturing plant recently destroyed by fire. Pittsburgh is asking bids until Nov. 23 for superheaters and coal-feeding apparatus for the Ross pumping station; the Eastern Shore Public Service Company, Salisbury, Md., is arranging for a transmission line right-of-way from Berlin to Snow Hill, Md., estimated to cost $80,000, and the City Council, Rockville, Md., is considering the installation of an ornamental lighting system in the downtown district.

New England Buys Power Equipment

Heavy power equipment orders placed in the New England district totaled approximately $500,000. Of special interest is an order for a 2,000-hp. and two 800-hp. motors for the American Steel & Wire Company, Worcester, Mass. Another order reported consists of three turbo-generator units of 1,000 kw., 1,500 kw. and 2,000 kw., respectively. An order consisting of one 800-hp. and two 300-hp. motors, as well as one 1,000-kw. turbo unit with switching and control equipment, also was placed. In southern Connecticut a number of smaller orders were noted. An order from the Twin States Gas & Electric Company for equipment replacement amounted to $100,000.

Central-station and distribution material are in active demand owing to losses in the recent flood which devastated northern New Hampshire and Vermont. One manufacturer reports orders for reconditioning equipment amounting to over $40,000 and jobbers note several inquiries for line materials, insulators, hardware and wire. Over 100,000 ft. of heavy telephone communication wire was ordered for emergency temporary reconstruction purposes, and conduit is moving rapidly for replacements. One manufacturer reports that general sales for the flood district amount to about $10,000.

Appliance business gained in volume. A 405-kw. electric baking oven was ordered from a Hartford (Conn.) company. A group of prominent central-station companies show about a 20 per cent increase as compared with last year. The Boston & Maine Railroad has announced plans for rebuilding the North Station, Boston, at a cost of about $10,000,000.

Large Transformer Order Placed on Pacific Coast

The outstanding order on the Pacific Coast covers 8 large transformers for a local power company. The units have a total capacity of 70,000 kva. and a value of $250,000. Industrial business is very good and includes such orders as 150 small motors valued at $5,000 for a manufacturer of oil burning equipment, 100 1/20-hp motors valued at $2,000 for manufacturer of calculating machines, 4 40-hp. crane motors valued at $3,500 for a Los Angeles steel mill, a 125-hp motor costing $2,000 for a chocolate factory, and a 75-hp. motor and 3 50-kva. transformers amounting to $2,500 for a pineapple plantation of the Hawaiian Islands. A cement company of Riverside has ordered 3 distributing switchboards and meter equipment including 30 watt-hour meters with a total value of $7,000, the latter to be used in a group of employees cottages. A sugar refinery on San Francisco Bay has ordered 2 40-hp. motors and special control equipment valued at $2,500. Manufacturers report a fair demand for oil well drilling motors and pumping motors.

A contract approximating $63,000 for furnishing motor-generator sets for the Puget Sound navy yard at Bremerton, Wash., has been secured by the Seattle office of the General Electric Company. Other awards announced include $6,000 worth of motors for a grain elevator for the port of Kelso, 18 motors for additions to a pulp and paper mill, a 2,000-kw. transformer for a lumber mill in Tacoma, Wash. Seventy-five electric heaters were bought for use in the Seattle million-dollar municipal auditorium. Other orders for equipment for the auditorium also will be placed soon for two twenty-five, six fifteen, and six three-quarter horsepower motors for operating fans. The City of Seattle purchased about $2,000 worth of 65 ft. and 75 ft. cedar poles. The pole market is quiet with central-station companies purchasing minimum requirements. A street lighting installation costing in excess of $11,000 was awarded by Vancouver, Wash. The Puyallup and Sumner Fruit Growers Association at Puyallup is planning a $75,000 electrified canning plant, and the Milton Box Company at Milton, Ore., plans spending $65,000 in constructing an electrified sawmill.

Construction projects reported are the following; The Board of City Trustees, Inglewood, Cal., plans the installation of an ornamental street lighting system. The West Stanislaus Irrigation District, Patterson, Cal., has permission to issue bonds for $1,216,376, for extensions in its system. The Mountain Ice Water Company, Redlands, Cal., plans construction of a manufacturing plant to cost about $60,000; the City Council, San Diego, Cal., is arranging an ordinance for an ornamental lighting system; the Doyle Ice & Storage Company, Colorado Springs, Colo., is planning the construction of an ice-manufacturing plant; The Utah Ice & Storage Company, Salt Lake City, Utah, is planning the construction of an ice-manufacturing plant at Gunnison, Utah. The Board of Public Works, Seattle, Wash., will soon ask bids for a 14,000 kva. generator set, with 15,000 kva. transformers, switchboard and auxiliary equipment for Cedar Falls.

Little Change in Middle West —Construction Active

Very little change in business conditions is noticeable in the Middle West. Apparently the volume is about the same with a slightly increasing tendency. Industrial activity is constant, with decreased activity in the steel and railroad industries. Mail-order houses in Chicago are apparently enjoying good business. The various utility companies are busy with considerable construction work while other construction work is slow. Considerable purchasing of apparatus includes the following items: Three 13,000-amp. 1,200-volt synchronous booster lighting converters; 22 13,200-volt potential transformers; 100 10-kva., 35-37½-kva., 35-50-kva. and 25-75-kva. distribution transformers; twelve 500-kva. power transformers; 27 current transformers, and a contract valued at over $2,000,000 for completion of superstructure of a large utility plant. Not much change is noticeable in the jobbers' volume of business. Seasonal activity and increased industrial activity is producing satisfactory business.

Construction activities include the following: Swift & Company, Chicago, plans the construction of a cold-storage and refrigerating plant at Altamount, Ill., to cost in excess of $75,000. The City Council, Des Moines, Iowa, is considering the installation of an ornamental lighting system on both sides of West Ninth Street, Grand Avenue and other streets. The Manning Light Company, Manning, Iowa, is considering the construction of a steam-operated electric power plant to cost about $150,000. The Otter Tail Power Company, Fergus Falls, Minn., plans the rebuilding of the portion of its power plant at Willow City, N. D., recently destroyed by fire. The Ohio Power Company, Canton, Ohio, is planning for extensions to the steam-operated electric generating plant at Philo, Ohio, to include 165,000-kw. turbo-generator, and new transmission lines; the project will cost about $10,000,000. The Northern States Power Company, Chicago, has approved plans for the construction of a transmission line from Rice Lake to Brill, Miss.

Motor Demand Improves in St. Louis District

One manufacturer in the St. Louis district reports a small improvement in the demand for stock sizes of industrial motors. Orders were reported for two switch-boards, one for Oklahoma to cost $1,500; the other for northeast Texas costing $4,500. Manufacturers of cooking and heating appliances are working full-time filling orders for the coming holiday season. Jobbers are shipping radio apparatus and small appliances in good volume. There has been a falling off in shipments of line and building construction materials since the last report. Most of the retail dealers are well stocked with Christmas electrical goods.

Pending construction includes the following: The Empire District Electric Company, Joplin, Mo., is considering the construction of a transmission line from Purdy to Cassville and Butterfield. The Lincoln Power Company, Poteau, Okla., has approved plans for the construction of a hydro-electric power plant on the Poteau River, near Poteau, to cost about $400,000, with transmission line. The Common Council, Mansfield, Tex., plans extensions and improvements in the municipal plant. The Central Power & Light Company, San Antonio, Tex., has secured a preliminary permit for a 25,000-hp. hydro-electric power development on the Devil's River to cost about $1,000,000, with a transmission system. The City Ice Company, San Antonio, Tex., plans the construction of an ice-manufacturing plant on Pleasanton Road, estimated to cost $90,000. The Gulf Public Service Company, New Iberia, La., is acquiring a right-of-way for the construction of a transmission line from Jacksonville to Troup, Tex.

Activities of the Trade

Sterling Electric Motors Organized in California

To manufacture a new line of electric motors, grinders, buffers and polishers, Sterling Electric Motors, Inc., 124 West Fourth Street, Los Angeles, has been organized. The company has purchased property with spur track facilities in the industrial tract of the Union Pacific Railroad. The property has a frontage of about 500 ft. on Telegraph Road at the corner of Atlantic Avenue. The company states that the factory will be equipped with modern rapid-production machine tools and apparatus and it is planned to be in production by Jan. 1, 1928.

The officers and directors, who have been closely identified with the electrical manufacturing business in California for many years, are: Carl E. Johnson, president and general manager; J. M. Sharp, vice-president; Earl Mendenhall, secretary and chief engineer; Allen A. Adams, treasurer and superintendent, and Horace S. Walling, sales engineer.

General Cable Corporation Approved by Stockholders

The merger of the Dudlo Manufacturing Corporation, the Rome Wire Company, the Safety Cable Company, the Standard Underground Cable Company and the Baltimore Copper Smelting & Rolling Company as the General Cable Corporation, the plans for which were announced in the Oct. 22 issue of the ELECTRICAL WORLD, has been approved by the stockholders. The corporation has an authorized capital consisting of $16,000,000 of first mortgage 5½ per cent bonds, $30,000,000 of 7 per cent cumulative preferred stock, 750,000 shares of no-par class A and 3,000,000 shares of no-par common stock.

The following officers and board of directors were elected at the first meeting of the board of directors of the new corporation: Walter Robbins, president; Joseph W. Marsh, chairman of the board of directors; W. C. Hall, treasurer; G. C. Thompson, controller; G. K. B. Wade, special signing vice-president; Alfred A. Cook, general counsel, and H. T. Dyett, Walter F. Field, George A. Jacobs, P. H. W. Smith and Roger Strauss, vice-presidents. The executive committee is composed of F. H. Brownell, chairman; H. T. Dyett, Walter F. Field, George A. Jacobs, Walter Robbins and P. H. W. Smith, with the chairman of the board of directors as an ex officio member. The directors are C. Albrecht, H. W. Barnard, F. H. Brownell, H. T. Dyett, Walter Field, Edwin A. Fish, Samuel L. Fuller, W. C. Hall, Charles D. Hilles, George A. Jacobs, C. J. Marsh, J. W. Marsh, Clifton M. Miller, F. M. Potter, Walter Robbins, P. H. W. Smith and Roger Strauss.

M. W. Kellogg Company Issues New Bonds

A first mortgage sinking fund 5½ per cent gold bond issue of $1,000,000 was offered on Thursday by the Guaranty Company of New York on behalf of the M. W. Kellogg Company, Jersey City, N. J., manufacturer of penstocks and other equipment. The proceeds of these bonds are to be used for the expansion of manufacturing facilities incident to the development of the company's new manufacturing process for the manufacture of heavy tanks and similar products and for general corporate purposes.

FAIRBANKS, MORSE & COMPANY, Chicago, reported for the quarter ended Sept. 30, 1927, a net income of $572,477 after depreciation, debenture interest and federal taxes. An item appearing on page 971 of the Nov. 5 issue of the ELECTRICAL WORLD did not include the fact that the net income was reported after the deduction of debenture interest as well as depreciation and federal taxes.

THE SPLITDORF-BETHLEHEM ELECTRICAL COMPANY, Newark, N. J., is now offering a new issue of $1,250,000 five-year 7 per cent convertible debentures with detachable stock purchase warrants. The proceeds will be used to provide additional working capital and to expand the business. The company recently acquired the Perfection Appliance Company of Detroit as announced in the Oct. 1 issue of the ELECTRICAL WORLD.

THE EDWARDS ELECTRIC COMPANY, Nicholas Avenue, Toledo, Ohio, has purchased property on Tracy Street and is said to be planning to use the site for a new factory addition, to cost more than $50,000 with equipment.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, East Pittsburgh, Pa., has completed plans for the construction of a new one-story plant at Ithaca, N. Y., estimated to cost about $75,000, with equipment.

RAINBOW LUMINOUS PRODUCTS, INC., 120 Broadway, New York, manufacturer of luminous tube-lighting apparatus, has work under way on a new plant at Detroit, to be operated as a branch of the main factory at Long Island City.

THE FALK CORPORATION, Milwaukee, manufacturer of herringbone gears, speed reducers and flexible couplings, announces the appointment of H. R. Harris, 1123 Metropolitan Life Building, Minneapolis, as representative to cover Minnesota as well as Douglas County, Wisconsin.

THE WIREMOLD COMPANY, Hartford, Conn., announces that a number of radical changes have been made in the tubing and in virtually every one of the original Wiremold fittings as the result of the work of a committee of experts and executives which was organized some years ago for the purpose of bringing the Wiremold system to the highest possible state of electrical and mechanical perfection.

FREDERICK HAASE announces the establishment of sales and display headquarters at 1165 Broadway, New York City, for representing a limited number of manufacturers in the electrical and hardware specialty fields. Mr. Haase, who was formerly vice-president in charge of sales for the Frank E. Wolcott Manufacturing Company, also announces that he has been appointed Eastern sales manager for the All Rite Company, Rushville, Ind., manufacturer of electrical specialties.

New Equipment Available

Cinder Trap

Green's cinder trap for the removal of cinders from the chimneys of boiler plants has been placed on the market by the Green Fuel Economizer Company, Beacon, N. Y. The trap consists of a battery of elements set vertically and arranged in staggered double rows mounted in a frame or casing of suitable design and rigidity ready for installation in a horizontal portion of the smoke flue. The entire unit is placed above a bin or hopper, of special shape and design, into which the lower ends of the trap elements project.

The elements divide the flue gases containing cinders into vertical strata which make an abrupt change in direction. The cinders are trapped in the elements and drop into the hopper below. A small volume of gases passes vertically downward along the elements with the cinders, thus aiding gravity. This volume of gases returns to the main flue through the opening at the rear of the elements. A special arrangement of baffles in the hopper is said to prevent the cinders being carried through with the gases into the main flue.

A general summary of the performance of the cinder trap under test conditions of the manufacturer which simulated as nearly as possible the actual conditions in a boiler flue showed the following: Computed by weight, the cinder trap removed 80 per cent to 96 per cent of the solids from the flue gases; the draft loss at a velocity of 3,000 ft. per minute and a temperature of 450 deg. F. did not exceed 0.16 in. of water; the concentration or grams per cubic foot of cinders in the gases did not affect the efficiency and the efficiency varied with the velocity of the gas, the percentage of fine cinders and the design of the hopper. The gram size of the cinder used for the tests ranged between the following:

Screen Size	Per Cent by Weight Remaining on Each Sieve	
	Sample A	Sample B
40	1.38	86.25
60	6.90	8.125
80	13.78	2.50
100	13.10	0.625
200	48.30	1.25
Passed through	16.54	1.25

Heavy-Duty Bus Support

FRANKLIN HEAVY-DUTY MULTIPLE CABLE BUS SUPPORT USING DIE-CAST METAL CONSTRUCTION

Made by the Railway & Industrial Engineering Company, Greensburg, Pa.

Automatic Welder for Range Boiler Heads

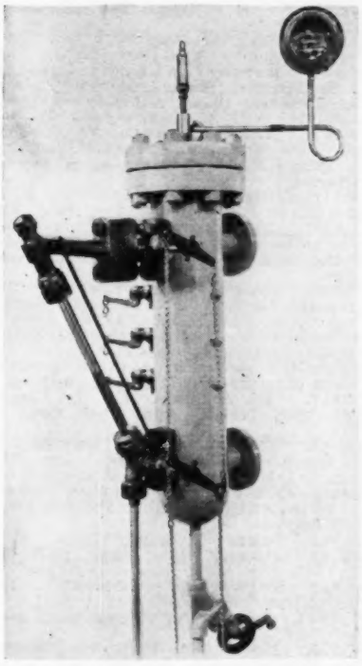
A new "Stable-Arc" carbon-arc automatic welding machine has been placed on the market by the Lincoln Electric Company, Cleveland. The machine is designed for the purpose of welding the heads in range boilers. In operation the tank is mounted on a rotating table in an inclined position. The rotating table is driven by a small variable-speed motor which provides speed adjustment for tanks of various diameters. Roller rests are provided which maintain the alignment of the work. The carbon electrode is carried by an adjustable arm supported from a rigid pedestal on which the motor starter is mounted. No filler metal is required in this operation, the head being flanged and inserted so that a lap joint is secured as in a riveted tank. The heat of the arc melts the edge of the lap weld of the cylindrical sheets, fusing it with the head and forming a solid, leak-proof joint. On 14-gage material seams have been welded at the rate of 135 ft. per hour. While these machines were developed primarily for welding range boilers they are equally applicable for welding all kinds of small cylindrical tanks.

Automatic Motor Starters

A line of inclosed automatic direct-current motor starters of the counter-c.m.f. type has been developed by the Ward Leonard Electric Company, Mount Vernon, N. Y. The starters are provided with low-voltage protection and low-voltage release, and they are said to be no larger than an open-type starter. The starting resistor for these units is placed outside of the inclosure for the contactors and is of the sand-box type. The three sizes of starters are: ¼ hp. to 3 hp., 5 hp., and 7½ hp. to 10 hp. The same contractors are used on all sizes up to 3 hp., and likewise the same contractors are used on the other sizes. Any starter may be changed to any other rating of that size by changing the resistor, provided the operating voltage is not changed. These starters can be controlled by a momentary-contact push-button station or by a maintained contactor switch such as a pressure regulator or float switch.

Boiler-Water Column and Gage

The boiler-water column and the inclined water gage illustrated are a recent development of the Yarnall-Waring Company, Philadelphia. The column is available in three types to cover a complete pressure range up to 650 lb. boiler pressure. It is furnished



INCLINED WATER GAGE AND BOILER-WATER COLUMN FOR IMPROVING VISIBILITY OF LIQUID COLUMN

with a high-water and low-water alarm as standard equipment. The inclined water gage, which carries the trade name "Sesure," is also standard equipment.

The gage has been designed as an independent device so that it can be furnished for any make of water column now in service. The column body is forged from a solid steel billet. The outside diameter is that of standard 6-in. pipe. The wall thickness is approximately ¾ in. The forging has been made of ample length to provide for settlement space below the lower water connection. It is made straight in section to provide for uniform strength and to eliminate any constriction above the sediment space. An important feature of the whole assembly is that the glass and column lie in line with each other and are not offset. In accordance with standard practice the column is drilled on both sides for the try cocks so they can be assembled for either hand. Standard try cocks of accepted make are furnished in accordance with the customer's desires.

Electrical Patents

Announced by U. S. Patent Office

(Issued Oct. 25, 1927)

1,646,862. INDUCTION FURNACE; W. Hoskins, Chicago, Ill. App. filed June 3, 1927.

1,646,869. ATTACHMENT CORD; C. E. Orndorf, Johnstown, Pa. App. filed May 8, 1926. Terminal connectors for flexible conductors.

1,646,882. THERMOSTATIC SWITCH; F. W. Schwinn, Chicago, Ill. App. filed Oct. 5, 1925. Adapted for use in connection with refrigerating apparatus.

1,646,888. RELAY SWITCH; H. E. Trent, Lansdowne, Pa. App. filed March 29, 1924.

1,646,890. BINDING POST; C. D. Tuska, Hartford, Conn. App. filed July 21, 1924.

1,646,904. AUTOMATIC CIRCUIT BREAKER; G. S. Fischer, Berlin, Germany. App. filed June 23, 1925. Adapted for use in connection with an electric flatiron.

1,646,909. CLAMP TERMINAL; W. E. Gossling, New York, N. Y. App. filed July 30, 1920. For terminal post of storage batteries.

1,646,911. ELECTRIC IRON SWITCH; F. H. Hanley, Detroit, Mich. App. filed Feb. 9, 1923. Including one or more resistance coils by which the ironing surface of the iron is heated for ironing purposes.

1,646,912. STEAM GENERATING AND DISCHARGING DEVICE; E. E. Hodshon, Nutley, N. J. App. filed Aug. 6, 1926. Adapted to receive a small charge of water, quickly convert it into steam and discharge the steam in a given direction at low pressure and in a dry condition.

1,646,917. RAIL BOND; C. L. Larson, Worcester, Mass. App. filed Nov. 19, 1926.

1,646,943. ELECTROMAGNETIC SWITCH; H. N. Wade, Milwaukee, Wis. App. filed Aug. 7, 1919. Responsive at a given frequency of the current supplied thereto, but unresponsive at other frequencies of such current.

1,646,962. SEWING-MACHINE MOTOR; F. F. Hillix, Cleveland, Ohio. App. filed Jan. 15, 1925.

1,646,964. SWITCH MECHANISM; C. L. Hopkins, River Forest, Ill. App. filed July 31, 1924. Suitable for electric lamp sockets.

1,646,974. METHOD OF WELDING STRUCTURAL MEMBERS; F. H. Moyer, Canton, Ohio. App. filed Aug. 20, 1926. Electric machine welding of bar sections.

1,647,002. ELECTRIC APPLIANCE SUPPORT AND CONNECTION; J. W. Hooley, Larchmont, N. Y. App. filed Feb. 12, 1926.

1,647,008. WIRE OR CORD HANGER; W. H. Lawrence, Boston, Mass. App. filed July 18, 1924.

1,647,010. ELECTRIC CIRCUIT BREAKER; G. S. Marston, Westminster, England. App. filed April 1, 1927. Air break.

1,647,020. SPEED-REGULATING SYSTEM; K. Schmidt, Berlin, Germany. App. filed Jan. 15, 1924. For prime movers.

1,647,021. ELECTROLYTE SEAL AND PROCESS OF MAKING THE SAME; E. A. Schumacher, Brooklyn, N. Y. App. filed Oct. 16, 1923.

1,647,053. PEDESTAL LAMP; R. Pfaffle, Schwenningen-on-the-Neckar, Germany. App. filed Feb. 12, 1926.

1,647,065. GUARD; J. L. Vaughan, Shawsville, Va. App. filed June 28, 1926. Means for preventing persons accidentally touching a trolley wire or the like with their heads when the wire is in a low position as in low parts of mines, tunnels and the like.

(Issued Nov. 1, 1927)

1,647,139. MANUFACTURE OF INCANDESCENT LAMPS; C. F. Lorenz, East Orange, N. J. App. filed June 23, 1922.

1,647,147. ELECTROMAGNETIC PUMP; L. H. Roller, White Plains, N. Y. App. filed May 2, 1924. Operates on the principle of the solenoid.

1,647,187. JUNCTION BOX FOR PORTABLE LIGHTS; H. G. Moore, Buffalo, N. Y. App. filed Jan. 24, 1923.

1,647,192. APPARATUS FOR CONTROLLING THE FREQUENCY OF AN ALTERNATING CURRENT; H. Nyquist, Jackson Heights, N. Y. App. filed Dec. 19, 1923.

1,647,212. VACUUM-TUBE ECHO SUPPRESSOR; G. Crisson, East Orange, N. J. App. filed Sept. 18, 1925.

1,647,236. ELECTRICAL TESTING SYSTEM; M. B. Long, East Orange, N. J. App. filed May 29, 1922. For measuring the impedance of electrical apparatus.

1,647,250. ELECTRIC SWITCH; E. Ratner, New York, N. Y. App. filed April 2, 1924. Pull-chain switch suitable for use as a socket switch.

1,647,251. SPLICE HEAD FOR ELECTRIC CABLES; A. C. Rumble, Los Angeles, Cal. App. filed Nov. 19, 1925.

1,647,266. VOLTAGE REGULATOR; A. F. Brotz, Kohler, Wis. App. filed Aug. 8, 1923. Designed to vary the speed of the generator correspondingly with the variations in the load to maintain an approximately constant voltage.

1,647,270. SYSTEM FOR INDICATING FREQUENCY CHANGES; E. T. Burton, Jackson Heights, N. Y. App. filed March 7, 1924.

1,647,282. SAFETY DEVICE FOR ELECTRICAL CIRCUITS; O. Dreyer, Essen-on-the-Ruhr, Germany. App. filed May 7, 1925. Renewable fuse and thermal releasing unit.

1,647,288. LIGHTING FIXTURE; H. A. Framburg, Chicago, Ill. App. filed Feb. 1, 1924.

1,647,293. CONTROL APPARATUS; W. G. Horn, Wilkinsburg, Pa. App. filed April 25, 1921. For governing the movements of a plurality of doors, such as those employed in railway vehicles.

1,647,295. CONTROL SYSTEM; H. D. James, Edgewood Park, Pa. App. filed Aug. 17, 1920. Automatic protection of starting devices, such as resistors or transformers employed for starting motors.

1,647,296. ELECTRICAL HEATING OF METAL STOCK; E. S. Jeffries, Hamilton, Ontario, Canada. App. filed Dec. 26, 1923. Automatic.

1,647,300. ELECTRIC SWITCH; L. L. Kroupa, Chicago, Ill. App. filed Dec. 8, 1923. Adapted for use in circuit testers.

1,647,313. REGULATING OR CONTROL SYSTEM FOR DYNAMO-ELECTRIC MACHINES; T. W. Ross, Manchester, England. App. filed Aug. 15, 1925.

1,647,316. DEMAND-LIMITING RELAY; R. C. Schott, Brooklyn, N. Y. App. filed Sept. 23, 1924.

1,647,323. ELECTRIC PERCOLATOR; V. G. Vaughan, East Pittsburgh, Pa. App. filed Dec. 17, 1925. Thermally controlled.

1,647,326. PULL SOCKET; B. C. Webster, Jackson, Mich. App. filed May 4, 1926.

1,647,328. RELAY OPERATION INDICATOR; J. M. Zimmerman, Wilkinsburg, Pa. App. filed March 1, 1924.

1,647,331. RHEOSTAT; C. T. Allcutt, Pittsburgh, Pa. App. filed Feb, 8, 1918. For potentiometers and similar devices.

1,647,332. VECTOR-SUM VOLT-AMPERE METER; D. J. Angus, Indianapolis, Ind. App. filed May 15, 1922.

1,647,333. REGULATOR SYSTEM; J. H. Ashbaugh, Wilkinsburg, Pa. App. filed June 24, 1924. For flywheel balancer sets.

1,647,336. THERMOSTATIC RELEASING; W. M. Bradshaw, Wilkinsburg, Pa. App. filed Nov. 5, 1923.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Magdeburg, Germany (No. 28,099), for storage batteries.

An agency is desired in Magdeburg, Germany (No. 28,130), for hair clippers, vacuum cleaners and electric washing machines.

An agency is desired in Cairo, Egypt (No. 28,091), for electric cooking appliances.

Purchase is desired in Chicoutimi, Canada (No. 28,084), of electrical goods and batteries.

An agency is desired in Belgrade, Yugoslavia (No. 28,093), for floor-polishing machines and parts and vacuum cleaners.

Purchase or agency is desired in Lille, France (No. 28,159), for household electrical devices.

An agency is desired in Halle, Germany (No. 28,131), for electric motors, vacuum cleaners and electric washing machines.

Purchase is desired in Tallinn, Estonia (No. 28,134), of railway motors.

An agency is desired in Prague, Czechoslovakia (No. 28,132), for small electric refrigerators.

An agency is desired in Cape Town, South Africa (No. 28,127), for electric cooking stoves.

An agency is desired in Zurich, Switzerland (No. 28,128), for vacuum cleaners.

An agency is desired in Zurich, Switzerland (No. 28,110), for electric washing machines.

An agency is desired in Bucharest, Roumania (No. 28,129), for copper wire.

Purchase and agency are desired in Milan, Italy (No. 28,133), for copper wire.

Purchase is desired in Bombay, India (No. 28,065), of wiring supplies and fixtures.

Purchase is desired in Zeulenroda, Germany (No. 28,158), of electric wood-polishing machines.

Purchase is desired in Milan, Italy (No. 28,155), of X-ray equipment.

Schmid & Oberly, Inc., Calle Ortiz No. 5, Iloilo, P. I. are in the market for electrical materials and appliances of 220 volts, alternating current, 60 cycles.

Technisch Bureau R. Neil Williams, 65 Naripanweg, Bandoeng, Java, is desirous of securing an agency for an American electric refrigerator.

New Trade Literature

INDUCTION MOTORS.—Bulletin No. 102 issued by the Reliance Electric & Engineering Company, Ivanhoe Road, Cleveland, describes and illustrates its type AA fully inclosed fan-cooled "Reliance" induction motors with ball bearings for two-phase and three-phase alternating-current circuits.

WIRES AND CABLES.—The Rockbestos Products Corporation, New Haven, Conn., has issued a bulletin describing its wires and cables designed especially for wiring lighting circuits and all low-voltage auxiliaries in central stations and industrial plants, electric railway motors and other applications. It contains illustrations giving applications of "Rockbestos" wires and cables.

CENTRIFUGAL PUMPING UNIT. — The Allis-Chalmers Manufacturing Company, Milwaukee, is distributing leaflet No. 2094, describing and illustrating its type "SSU" centrifugal pumping unit.

CINDER TRAP.—The Green Fuel Economizer Company, Beacon, N. Y., has issued a bulletin which described and illustrates "Green's" cinder trap.

STRENGTH TESTS ON TREATED DOUGLAS FIR POLES.—A pamphlet containing a report of strength tests on pressure-creosoted Douglas fir poles has been issued by the Creosoted Douglas Fir Pole Producers, composed of the Pacific Creosoting Company, Seattle; J. M. Colman Company, Seattle; Charles R. McCormick Lumber Company, San Francisco, and J. H. Baxter & Company, San Francisco. The modulus of rupture for each of 35 poles tested is given in the test report.

ELECTRICITY. — The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued a publication, entitled "Electricity the Pathway of Prosperity," which gives details on general farm electrification, the electrical dairy farm, how to make poultry pay with electricity, making farm life better, economics of farm electrification, the right size of a motor to use and the cost of operation of electrical apparatus. In an item which appeared in the Oct. 29 issue, this publication was erroneously credited to the General Electric Company, Schenectady, N. Y.

COMPRESSORS, PUMPS, TURBINES AND SPEED REDUCERS. — Bulletin E-1107 issued by the De Laval Steam Turbine Company, Trenton, N. J., covers the De Laval centrifugal blowers and compressors, pumps, turbines and speed reducers for blast furnaces, steel plants and by-product coke-oven plants.

JET-CUTTING MACHINE.—A bulletin issued by the Hubar-Jones Corporation, 13 Astor Place, New York City, describes and illustrates the Godfrey oxygen jet-cutting machine for cutting and shaping steel, mild steel, chrome-nickel steel, manganese steel, cast steel and wrought iron.

CREOSOTED YELLOW-PINE POLES. —"Sentinels of Service" is the title of a catalog issued by the Long-Bell Lumber Company, Kansas City, Mo., which describes and illustrates the Long-Bell creosoted yellow-pine poles for telephone, telegraph and power-line construction. Many illustrations are given showing the treatment of the poles, as well as photographs of transmission lines where the poles are in use.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Customer Increase a Measure of Service Growth

IT HAS often been pointed out that electric light and power companies furnish a service as well as a commodity.

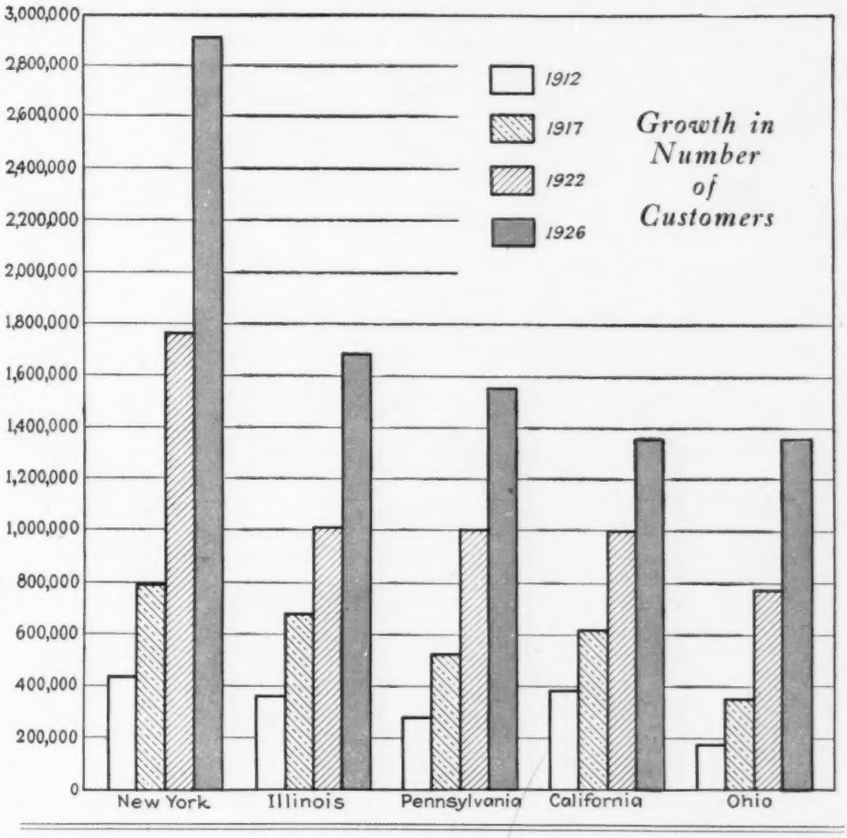
Several methods may be adopted for measuring that service; probably the most informing is to count the number of customers. Fortunately we have reliable data on the subject, consisting of government census figures at five-year intervals since 1907, while for the period since the last census in 1922 there are public utility commission records in about half the states and close estimates made by the ELECTRICAL WORLD on the basis of reports by operating companies in the others.

It has been urged that the statistics are inaccurate, consisting of a conglomeration of number of meters, number of active accounts, number of monthly bills and other figures that are reported when a survey of customers or consumers is made. The objection is a valid one in comparing individual company operations. But when entire states are contrasted, or the growth from year to year is to be determined, this objection is less serious. The difference between the several quantities mentioned is relatively small and the ratio of growth of each is substantially the same.

According to the latest data there were at the end of 1926 five states having more than 1,000,000 electric light and power customers each. In those five states were comprised 45 per cent of all such customers in the United States. The number includes domestic, commercial lighting and industrial power users, with a negligible fraction of others. Numerically by far the predominating class, constituting in most instances between 75 and 80 per cent of the total, is the domestic customers.

Details of the changes are shown in the chart and table. In the fourteen-year interval from 1912 to 1926 the total number in the five states increased over five and a half times. It was not far from doubling in the first half decade under consideration, and it came still closer to doing so in the second. There was virtually a threefold increase in the nine years from 1917 to 1926.

In the individual states the rate of growth seems in general to parallel the rapidity of industrial development and of population increase in the chief cities, as might be expected. That is notably true of Ohio. The comparatively moderate rates characterizing California are entirely consistent with the very high degree of electrification achieved as early as 1912, when that state was second only to New York in number of electric customers, though thirty-second in order of population. A ratio of one customer to six inhabitants was extraordinary fourteen years ago; as a national average it is only now being attained.



Number of Electric Light and Power Customers in the Five Leading States and Rates of Increase Since 1912

State	1912	1917	Ratio '17/'12	1922	Ratio '22/'17	1926	Ratio '26/'12	Ratio '26/'17	Ratio '26/'22
New York	434,110	794,516	1.83	1,760,418	2.22	2,915,073	5.72	3.66	1.66
Illinois	364,746	682,260	1.87	1,127,830	1.65	1,683,797	4.63	2.47	1.50
Pennsylvania	238,011	527,316	2.21	1,053,423	2.00	1,554,000	6.53	2.95	1.47
California	384,682	619,803	1.61	1,018,228	1.64	1,360,000	3.54	2.20	1.34
Ohio	174,467	353,183	2.02	774,605	2.19	1,358,408	7.80	3.85	1.75
Total in five states	1,595,316	2,977,078	1.87	5,734,504	1.92	8,871,248	5.55	2.97	1.54

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote or use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

Productive Activity in West Above Last Year

INDUSTRIAL activity in the Western States, as indicated by reports on the consumption of electrical energy received by the ELECTRICAL WORLD, appears to have taken an upward turn during September of greater magnitude than the reports of past years would presage. The September productive activity was 8.2 over August and was 3.7 per cent over September of last year.

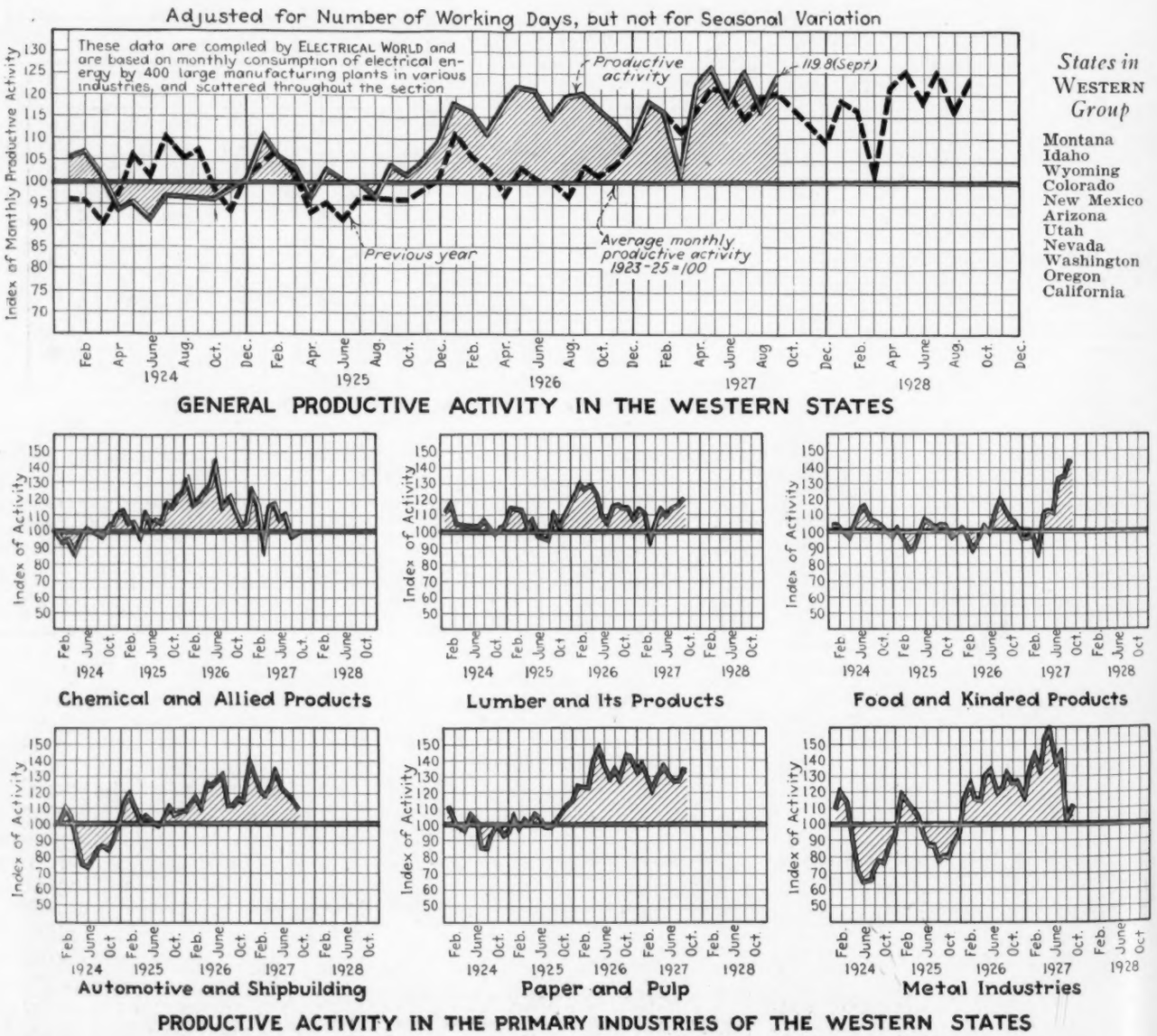
The various primary industries of the section showed varying tendencies. Three of the outstanding groups—food and kindred products, lumber and its products, and paper and pulp—reported activities over those of September last year. On the other hand, chemicals and allied products, shipbuilding and metals industries were operating slightly below last year. This condition approximates very closely conditions existent in the nation as a whole in that while some of the industries are operating at a high rate of activity others are below the expected activity at this season of the year. It appears, however, that the 1927 volume of production of the manufacturing plants operating in the Western States will exceed slightly that reported for 1926.

Indexes of Productive Activity in the Western States

All Figures Adjusted for Number of Working Days

	Sept. 1927	Aug. 1927	Sept. 1926	Average for First Six Months, 1927	Average for Full Year 1926
All industries (West)	124.6	115.3	120.2	116.3	115.7
Chemical and allied products	98.0	96.8	122.6	111.8	119.7
Food and kindred products	144.0	134.5	112.8	102.2	103.4
Lumber and its products	120.0	115.2	117.0	108.1	117.7
Metals group	111.2	99.6	132.7	143.7	123.7
Paper and pulp	135.2	127.2	126.8	131.3	134.2
Rubber and its products	117.8	111.0	.....	.....	.....
Transportation	101.2	106.2	111.4	124.8	120.8
Stone, clay and glass	151.6	142.3	.....	.....	.....
All industries (United States)	118.4	110.6	118.6	116.8	113.1

ELECTRICAL WORLD *Barometer of Industrial Activity in the Western States*


Adjusted for Number of Working Days, but not for Seasonal Variation
These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 400 large manufacturing plants in various industries, and scattered throughout the section
Index of Monthly Productive Activity
Productive activity
119.8(Sept)
Previous year
Average monthly productive activity 1923-25=100
States in WESTERN Group
Montana
Idaho
Wyoming
Colorado
New Mexico
Arizona
Utah
Nevada
Washington
Oregon
California
GENERAL PRODUCTIVE ACTIVITY IN THE WESTERN STATES
Index of Activity
Chemical and Allied Products
Lumber and Its Products
Food and Kindred Products
Automotive and Shipbuilding
Paper and Pulp
Metal Industries
PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE WESTERN STATES